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JANUARY 1, 1946

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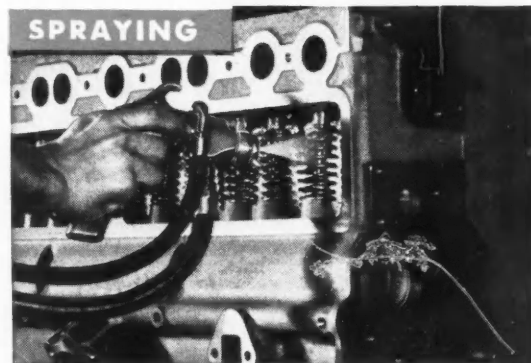
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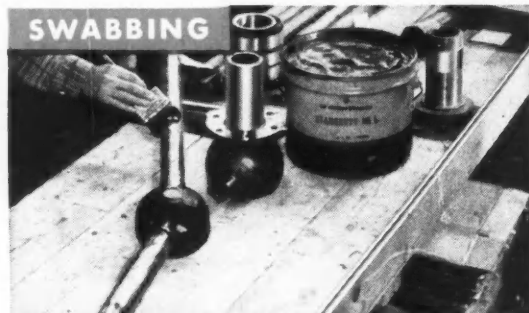
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# AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Volume 94

January 1, 1946

Number 1

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Philadelphia 39, Pa., Chestnut & 56th Sts., Phone Sherwood 1424  
New York 17, N. Y., 100 East 42nd St., Phone Murray Hill 5-8600  
Chicago 1, Ill., Room 916, London Guarantee & Accident Building, Phone Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison 2090; Cleveland 14, Ohio, 1030 Guardian Bldg., Phone Cherry 4188; Washington 4, D. C., 1061 National Press Bldg., Phone District 3109 and 3110; San Francisco 5, Calif., 605 Market St., Room 708, Phone Douglas 0967; Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.  
Cable Address .....Autoland, Philadelphia

Member of the Audit Bureau of Circulations  
Member Associated Business Papers, Inc.

AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by  
CHILTON COMPANY (INC.)

Executive Offices  
Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A.

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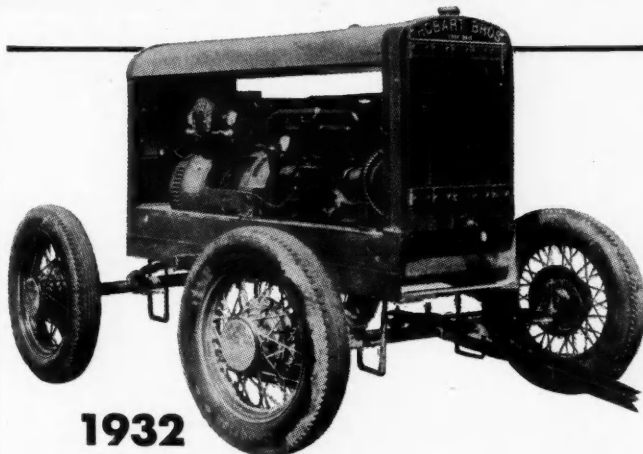
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January 1, 1946

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AUTOMOTIVE and AVIATION INDUSTRIES. Vol. 94, No. 1. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, \$1.00 per year. Canadian and Foreign \$2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

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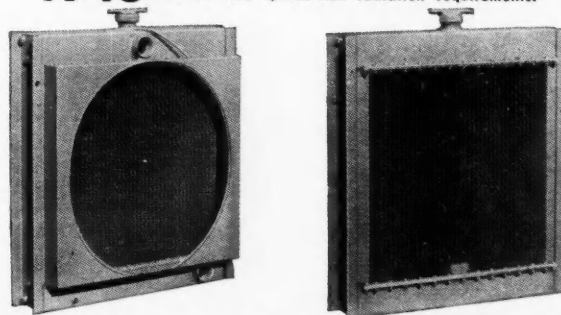
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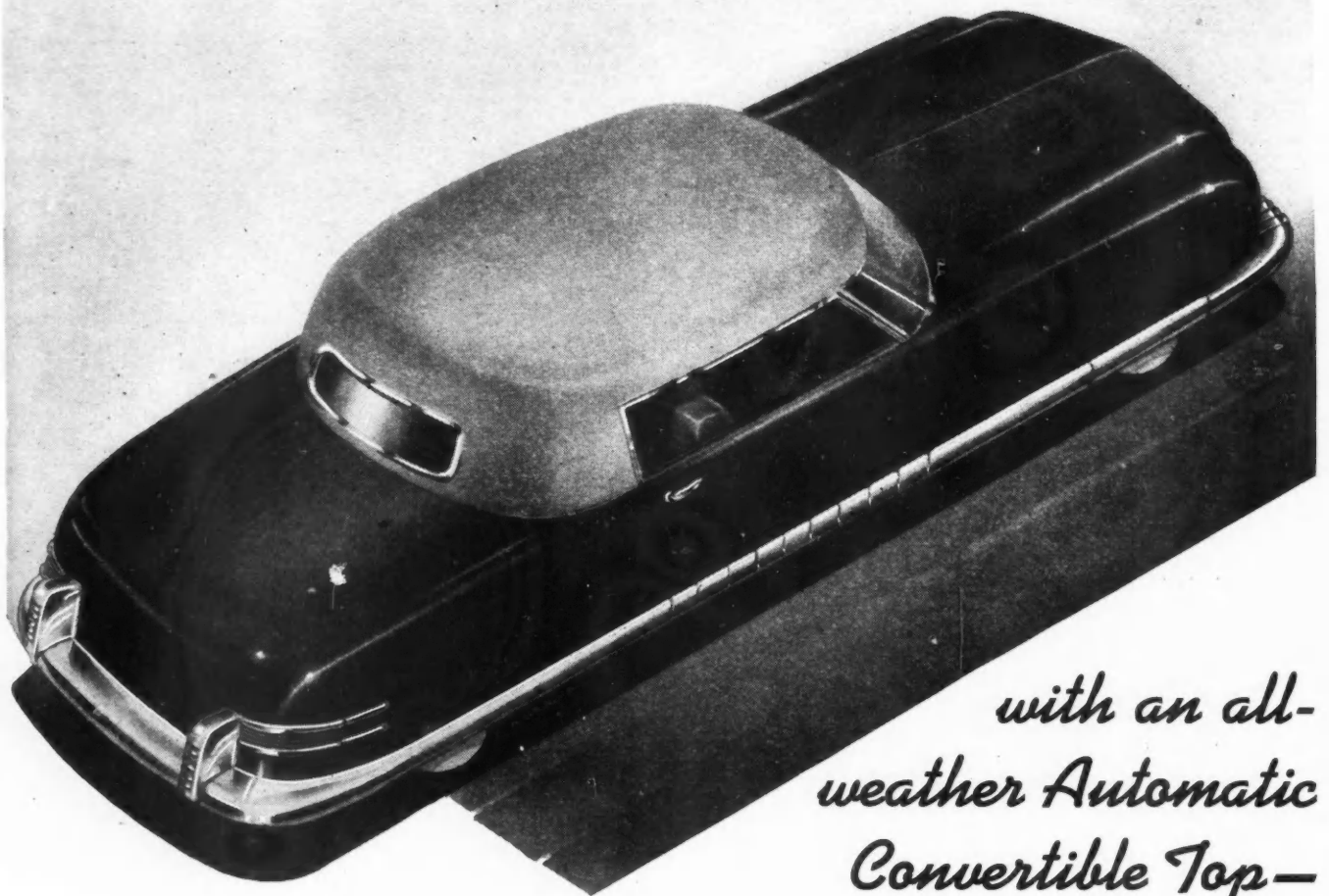


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## We Need More of What Has Made Us Grow

**By C. C. Carlton**

Vice President, Motor Wheel Corporation

**S**INCE World War II has thrust the United States of America into an unquestionable position of leadership among the nations of the earth, it seems to be high time that we Americans check up on ourselves. We ought to try to find out what we're good at, and do more of it. We need to know what makes us different, and what made us grow, in the brief span of 100-odd years, from a pip-squeak colony in the wilderness into the richest and most powerful nation on earth.

What, exactly, is the source of our strength? Is it manpower? Other nations outnumber us; China by as much as three to one. Is it natural resources? Other nations can top us on that score; Russia has more petroleum, lumber, minerals. Is it climate? A whole band of nations around the globe share our climatic belt. Is it size? Other nations have larger land areas; for example, Brazil, Canada, China and Russia. Is it our productive skill? Are we superior in technology? We seem to have equals in those fields: Great Britain and pre-war Germany in the industrial arts; Switzerland and Sweden in precision tools, pre-war Japan in low-priced consumer goods, and several nations in agricultural production. Is it our love of freedom? It plays a part, but we need to remind ourselves that other peoples share it, and that at least one people, the Swiss, have had it longer than we have, and guard it more jealously than we do. If it is none of these things, what is it that makes us different?

It is not one thing, but a combination of two things, both of them peculiarly American. The first is our love of competition. The second is our mastery of mass production.

Let's examine the last one first, for our mastery of mass production seems to stem, in part at least, from our love of competition. Other nations, notably the pre-war Japanese and Germans, seemed to be threatening our position in the field of mass-produced consumer's goods. But there was a significant difference in their approach. It is that difference of approach which is a basic difference between Americans and other peoples.

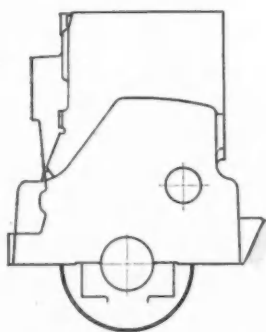
The idea of mass-production, or quantity production, as the British call it, is neither new, nor peculiarly American. History shows that Matthew Boulton, James Watt's partner and financial backer, tried it in England around the time when Americans were signing the Declaration of Independence. A few years later, the idea was translated into practice in France, when Napoleon had to have huge supplies for his mass armies. But, after those brief attempts in Europe had failed, the idea took hold in the United States. Adopted by such early American industrialists as Paul Revere, Eli Terry and Eli Whitney, among others, it

*(Turn to page 88, please)*

# ANGULAR BROACH

## TAILORED TO FIT THE JOB HANDLES 170 CYLINDER BLOCKS PER HOUR

Quite often the tooling and methods required to perform relatively minor operations on *standard machines* add far too much to the unit cost. Then it becomes more desirable to purchase equipment *tailored to fit the job* as the example shown here illustrates. ¶ Cylinder blocks for a well-known automobile have a small oil pump pad at a 63° angle. To machine these pads at a high rate of production, Cincinnati Application Engineers designed a special Angular Broach, which does this one operation—nothing else—but does it at a rate of 170 blocks per hour. The reason for this high production is that the operator is relieved of all duties except pushing block in, pressing a button to start the semi-automatic cycle and pulling the block out . . . all simple operations. ¶ The semi-automatic cycle engages locating bars, actuates supporting jack and clamps, and operates the ram. Cincinnati Application Engineers know the value of such features in low cost production. They will be glad to talk over your machining problems with you.



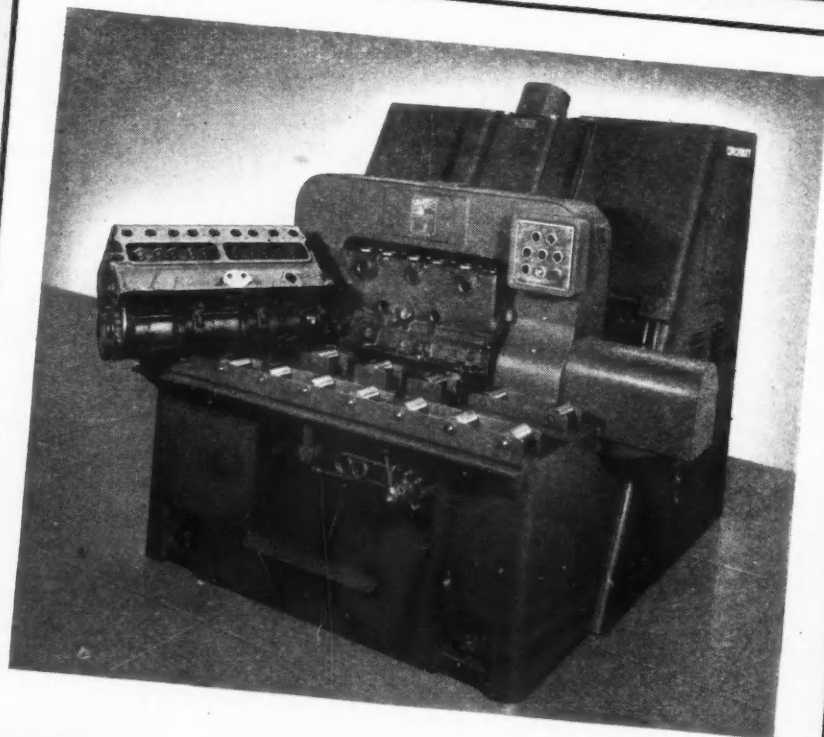
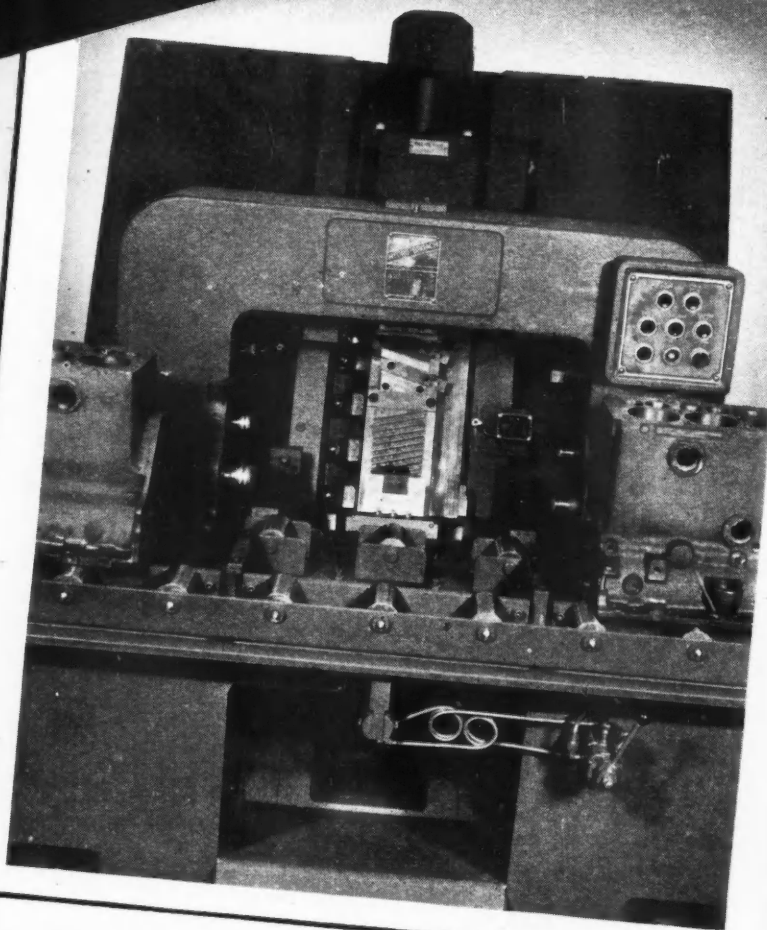
**Part Name**—Motor Block

**Material**—Cast Iron

**Operation**—Broach Oil Pump Pad

**Production**—170 per hour

**Machine**—CINCINNATI Special Angular Broach



Top photo: C  
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CINNATI Ang  
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# Let's Have Some Responsibility on the Union's Side

**A**LTHOUGH most of the sound and fury over the present labor turmoil has been centered on the merits of the UAW-CIO 30 per cent pay increase demand, a flanking movement launched unobtrusively by Chrysler Corp. in mid-November against union irresponsibility has swelled into a full-scale offensive with at least three other automobile companies making similar demands for security against unauthorized strikes or slowdowns. A major point in the Chrysler negotiations on a new contract was the demand for inclusion in the contract of a clause reserving to the company the right to discharge or otherwise discipline any employee causing or taking part in any unauthorized work stoppage and providing that the union agree not to take any step to oppose such discharge or discipline. However, before any agreement could be reached negotiations broke down and the old contract lapsed, leaving the union without any formal agreement. It is understood that Chrysler will stand fast and insist on some type of guarantee against wildcat strikes if and when a new contract is written.

Ford Motor Co. has probably been the most realistic and has come closer to realization of a concrete security provision than any other company. In a straightforward statement to the union, Ford pointed out that worker productivity has declined so alarmingly that the very future of the company is at stake and called on the union to present some type of guarantee against work interruptions. When none was forthcoming the company proposed that the union pay from its treasury to the company \$5.00 per day for each employee involved in an unauthorized stoppage. Richard T. Leonard, UAW-CIO Ford Director, then proposed that instigators of such stoppages or slowdowns be discharged and other participants fined \$3.00 to \$5.00 per day through a pay reduction. Ford did not immediately accept the proposal since the company feels that the penalty should be on the union which made the contract, and that there may be legal difficulties involved in fining workers directly. The matter still is under study.

Demands made by General Motors for inclusion in a new contract with the UAW-CIO show definitely that the corporation intends to obtain some concessions on security of its own prerogatives. It asks "That there be appropriate penalties, including loss of seniority, against any employee taking part in any strike or work stoppage in violation of the agreement." It also proposes that wages paid to union committeemen for time spent off their jobs in handling grievances or negotiating with the management be paid one-half by the union and one-half by the corporation. Another proposal is that the union give adequate guarantee it will make good on its pledge to eliminate personal attacks, false accusations, and vilification of management through official union publications and other means, and that the International Union shall accept full re-

sponsibility for such attacks. There also is a strong indication that GM will make a fight to throw out maintenance of membership. Point 2 of its list of proposals asks that "The union and the cor-

poration shall recognize the rights of employees and applicants for employment to elect or refuse membership in any union, to maintain or resign from such membership, to enjoy freedom from restraint, discrimination, and coercion with respect to work, employment, union membership and union activity."

The task of obtaining concessions involving union responsibility for loss of productivity through strikes, slowdowns and other means will not be easy. There already are repercussions throughout the unions, especially among dissident factions politically opposed to present leaders. There are reports of rebellion against Leonard in the Ford local. But after 10 years of operating under the Wagner Act, which imposes penalties on employers for violation of contract but says nothing about unions in this respect, management apparently is determined to accomplish what the Federal Government consistently has refused to do. In view of the alarming decrease in individual effort that has occurred since 1941, and the inevitable rise in wages that is coming they must regain their right

(Turn to page 96, please)

*By Leonard Westrate*



## *Simplified Design and Interchangeability of Major Parts SPEED*

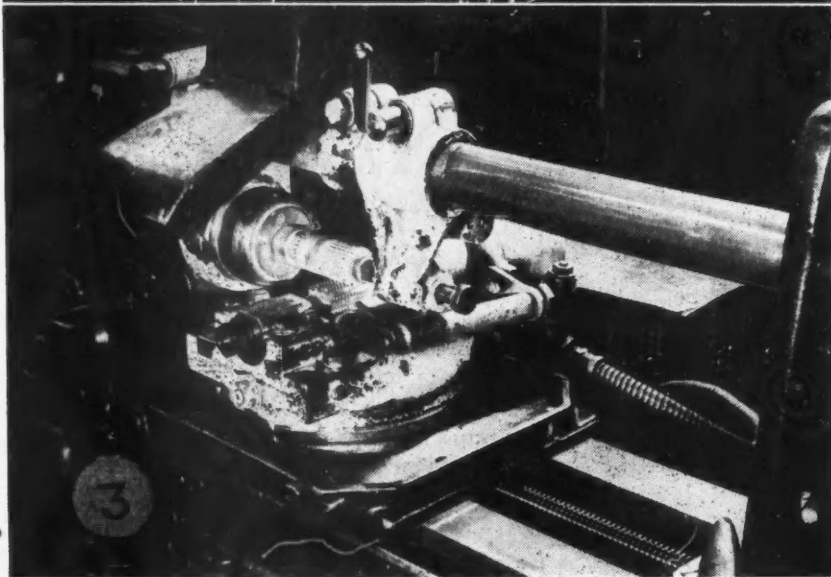
# Production

**F**ROM a modest beginning some 20 years ago when Fairbanks, Morse & Co. first manufactured magnetos for its own engines, the present Magneto Division of the company has gradually assumed imposing stature as a producer of magnetos for spark-ignition engines of many makes and types. In keeping

with wartime demands which accelerated production throughout the industry, the Fairbanks-Morse plant doubled and redoubled its output during the critical years. Post-war plans are now being carried out for an even larger volume.

Skillful planning and simplicity of design have resulted in a series of basic models which adapt themselves extremely well to the requirements of the field. Magnetos are built for engines of one to six cylinders, suitable for medium, commercial or heavy duty operation. In multi-cylinder models, jump—or carbon brush—distribution designs are optional. All magnetos can be furnished with impulse couplings, which facilitate engine starting by increasing the ignition spark output at low speeds, while at the same time retarding the spark to prevent dangerous backfiring.

The observer cannot fail to be



**1.** In the grinding department—grinding of the tapered end of the rotor shaft in a Cincinnati cylindrical grinder

**2.** One of a battery of Landis automatic grinders. This one is tooled for grinding the cam on the end of the rotor shaft

**3.** The pair of gears in the magneto is cut in Barber-Colman hobbors. Shown here is the hobbing of the molded gear. Note the hood and exhaust duct for removing dust and chips



By Joseph Geschelin

This is the 113th  
in the series of monthly  
production features

## of Magnetos at Fairbanks Morse Plant

impressed with the fact that despite the large volume of product and the variations in specifications, the plant operation is housed in a relatively small floor space with a minimum of manufacturing equipment, and a modest force of workers. This is a direct reflection of the sound policy of simple basic design which takes advantage of the most advanced methods and modern materials, a simplification leading to the minimum number of parts required in a single assembly, and full interchangeability of major elements. For example, only four basic frames—die castings—are required for the major group of models.

Full advantage has been taken of die castings and plastic molded parts not only to simply design but to reduce the number of machine shop operations as well.

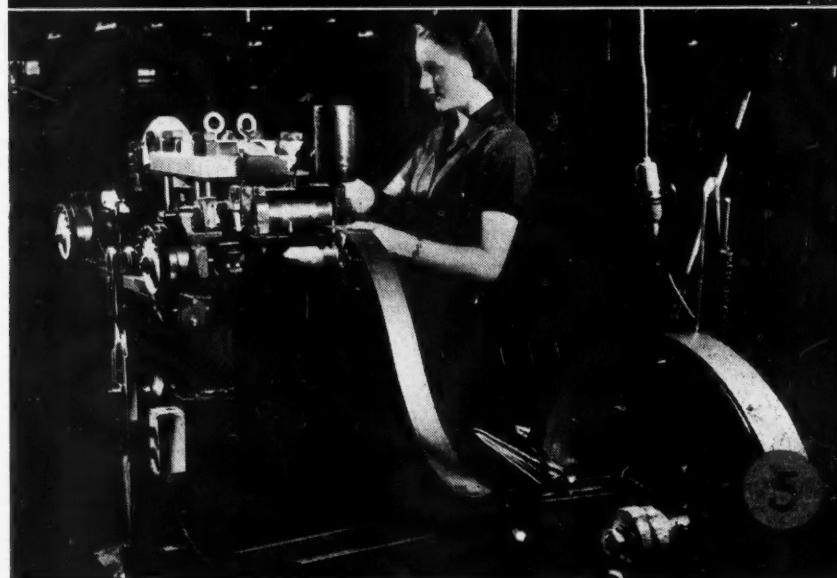
The F-M magneto is designed around the use of Alnico magnets which are cast as inserts within a die-cast aluminum rotor. Our readers are familiar with the unique advantage of Alnico magnets—particularly high flux intensity in a tiny package and lifetime permanency. These features combine to assure a fat intense spark under all engine operating conditions. With the lifting of wartime restrictions upon the use of critical materials, F-M has found it expedient to adopt aluminum for all of the die-cast parts, thus reducing the weight of the unit materially.

All of the die castings used in

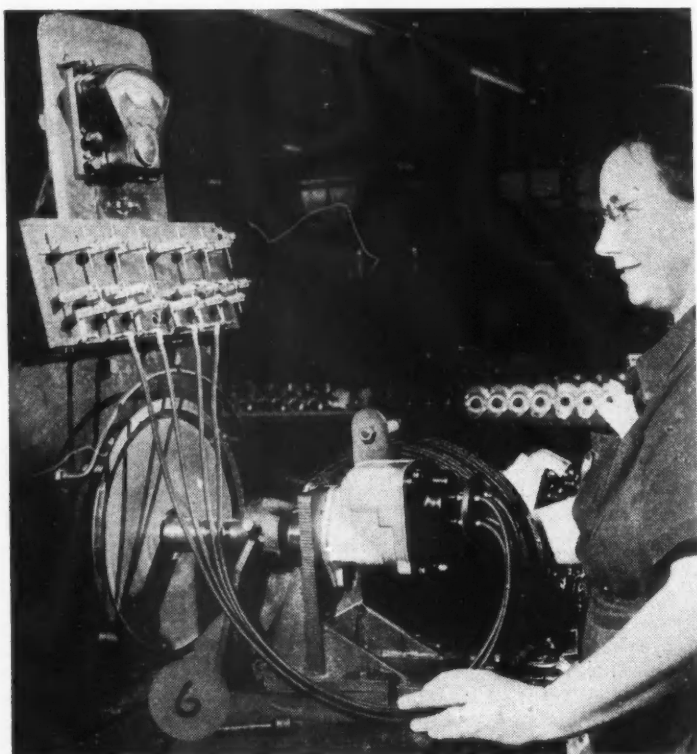
the magneto line are produced in a small self-contained department. Plastic molded parts are purchased from various suppliers, among these being a beautifully made Bakelite distributor cap produced by Barber-Colman. Another noteworthy feature from the standpoint of the user is the plastic distributor disc, containing a Monel-metal contact insert which has an



4. One of the magneto assembly benches



5. Millions of laminations required in magneto production are turned out on the familiar high speed automatic Henry & Wright dieing machines



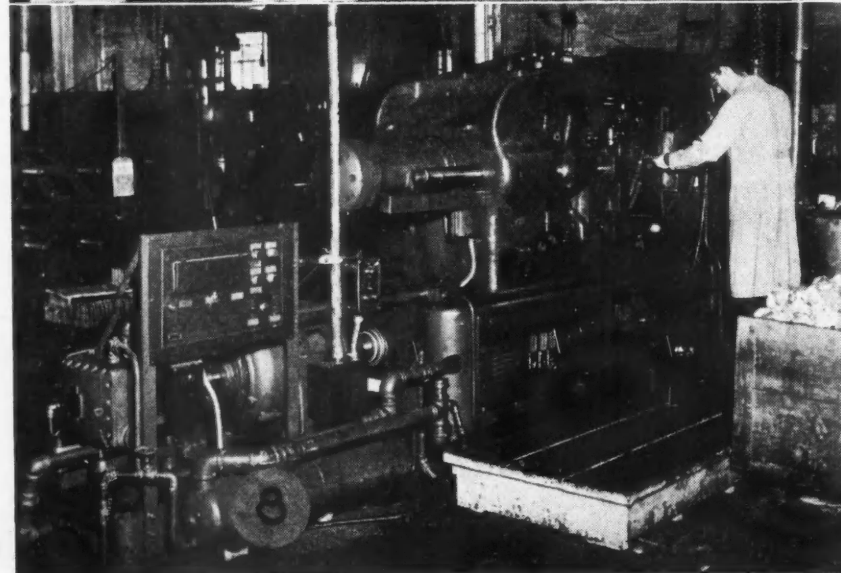
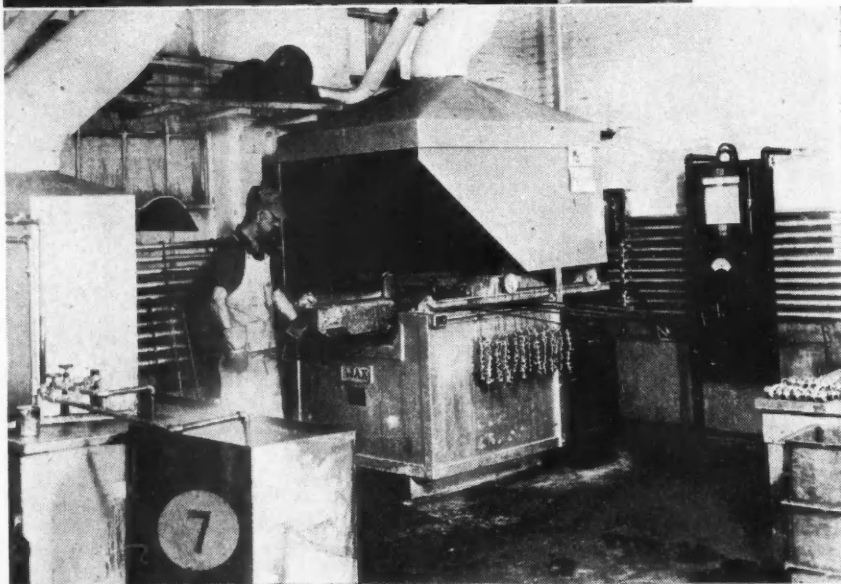
exceedingly long useful life. The coils are purchased from an outside supplier and finished here. The point to note is that this system of sub-contracting simplifies the production problem and exerts a great influence upon the nature and extent of manufacturing facilities.

Coming to the plant layout, we find it to be departmentalized to achieve the maximum of specialization and so arranged as to feed parts freely to the assembly benches. Each of the departments is provided with production equipment of the latest type.

Let us consider the major departments separately. Fabrication begins in the die casting department which produces aluminum castings for the main frame, the rotor, and the other parts. Frames are made in large horizontal die casting machines produced by the Phoenix Machine Co. As the castings come out of the machine they are burred and cleaned, then transported to the inspection department for visual and dimensional checking.

The magnetic rotor casting is quite interesting because of the inserts that are accommodated in the mold. From one to six Alnico magnets in different shapes and sizes are cast integrally with the rotor shaft and laminated pole pieces. Laminated assemblies forming the legs of the magnetic circuit are inserted in the frame casting.

Literally millions of lamination stampings are required for the magnetic circuit—for rotor pole assemblies, for coil cores, and for the pole shoe inserts in the frame. By virtue of the interchangeability of the magnetic circuit throughout the line, the design of laminations is simplified and the number of dies reduced to a minimum. This makes possible the use of high speed, automatic Henry & Wright dieing machines which maintain the large volume of lamination stampings without difficulty and with little attention to the machine once a setup has been made.



**6.** Intimate view of the large Synchroscope on which the final testing of magnetos is handled

**7.** Impulse coupling shells and hubs are hardened in the Ajax liquid salt bath furnace and quenching unit shown here

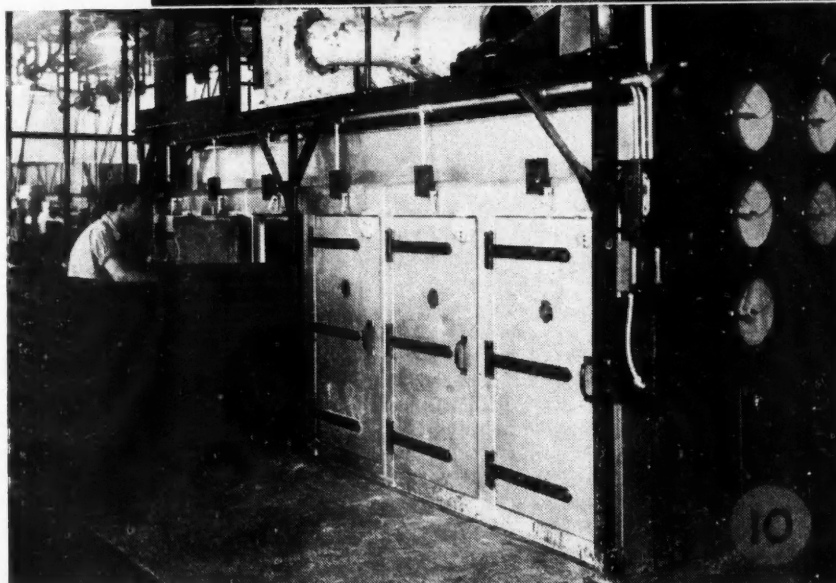
**8.** Large Phoenix die casting machine is employed for making the aluminum frame castings. Other equipment is provided for die-casting rotors and smaller parts.



The machine shop has many details of interest to production men. Consider, for example, the machining of main frames. We pointed earlier to the maximum interchangeability of major parts. The entire line is probably satisfied with four regular frames and perhaps two additional frames for four-pole magnetos. By simplification, it is perfectly feasible to machine all frames in one small cluster of machines tended by a few operators. The cluster contains among other items, a Lipe Carbo-Lathe and a Bardons & Oliver lathe for boring and facing operations; and a group of Leland-Gifford drills mounted on a single base to provide a special purpose drilling machine for drilling, tapping, counterboring, etc., of the various holes. This machine has four large heads and two small heads so disposed on the base as to permit a single operator to complete all of the operations on a frame simply by moving the work from one head to another. It can be appreciated that this machine can be used for any number of frames simply by changing the fixtures and tools. The work is scheduled in suitable minimum lots to assure economic runs.

The same principle of special machines built up from simple heads is extended to the drilling and tapping of other parts. For example, the laminated fibre breaker arm molding is machined on a three-head Leland-Gifford drill. The Bakelite distributor cap is drilled and tapped on a similar set-up which has four Delta heads. In each case, one operator seated at the center of the machine can reach all spindles conveniently.

The grinding department handles the variety of operations required on certain major parts. One section has two small Blanchard surface grinders for grinding Alnico magnets to length, and for the grinding of cores for coils. Since the magnets come in the form of

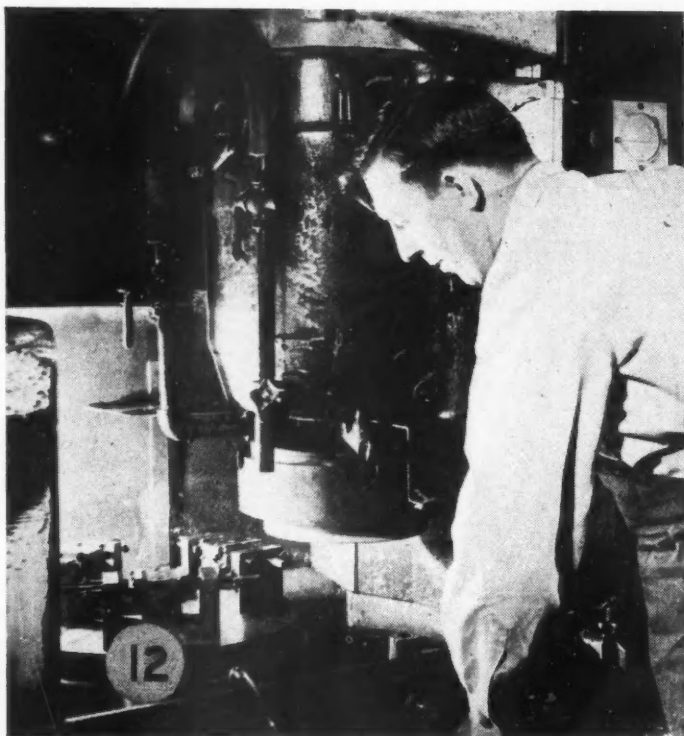


**9.** *On the assembly line—close-up of one of the Alnico magnet charging stations*

**10.** *After dipping in insulating varnish, magneto coils are placed in ovens for thorough drying. The operator is in act of charging one of the chambers with a load of coils. The oven shown here is one of two units supplied by R. C. Mahon*

**11.** *This four-head Delta drill bench is typical of similar arrangements of simple drilling heads integrated to provide a special-purpose machine. The unit illustrated here is used for the drilling, tapping, etc., of Bakelite parts*





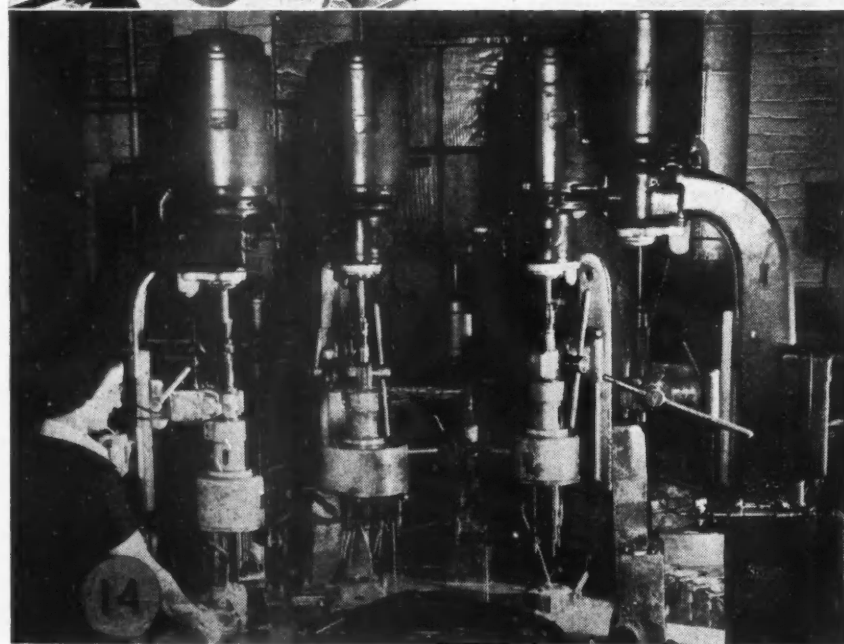
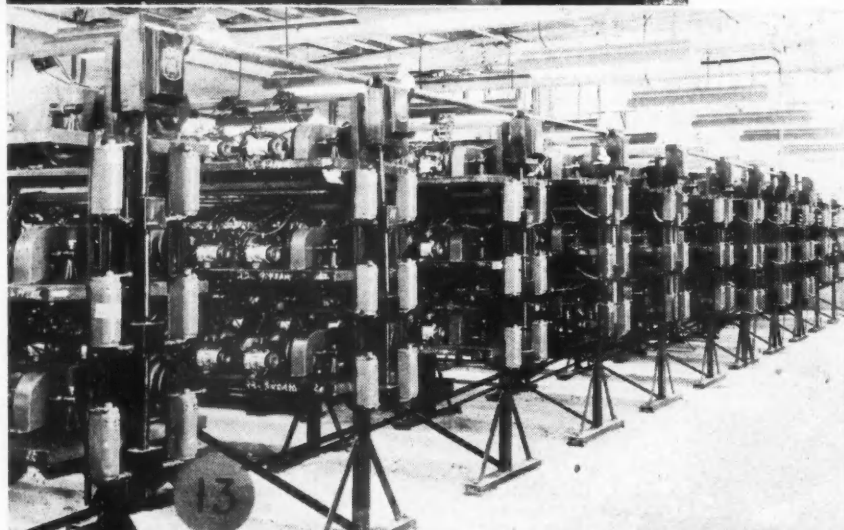
short cylindrical lengths, they can be mounted conveniently, a large number at a time, in a fixture on the magnetic chuck of the grinder.

A large section of the grinding department is devoted to the rough and finish grinding of rotor shafts and rotor assemblies. This department includes familiar items of equipment—Cincinnati cylindrical grinders of the latest type, Norton cylindrical grinders, and a battery of Landis automatic grinders. Some of the Landis machines are used for the grinding of the timing cam at the end of the rotor shaft. The shafts are formed and turned in the automatic department of the main plant, then rough-ground in the grinding department. Then the shafts are routed to the die-casting department where the rotors are built up and cast. Following this, the rotor assembly returns to the grinding department for the finishing operations, including cam grinding.

The coil department is another of the major stages. As mentioned earlier, wound coils are purchased from an outside supplier. Following receiving inspection, the coils are cleaned, then taped, and dipped in a special varnish. The coils are dried in special ovens built by R. C. Mahon, the drying time and temperature being automatically controlled. Following drying they go to an inspection bench for a thorough electrical checking procedure.

The multi-cylinder magneto incorporates two small narrow-faced gears for its distributor drive—one machined from a steel blank, the other from a molded blank. These gears are cut in a battery of two small Barber-Colman hobbers. It may be noted in passing that the hobber used for cutting molded gears, as well as the other machines in the plant which handle plastics, is equipped with a suitable hood and exhaust piping to remove the fine dust as it comes off the work.

*(Turn to page 76, please)*



**12.** *Word-head and magnetic chuck of a small Blanchard surface grinder which is used for grinding Alnico magnets, cores for coils, etc.*

**13.** *General perspective of the magneto test stands which have a capacity of 1200 units*

**14.** *Magneto frames are drilled, tapped, counterbored, etc., on this unit. It consists of six Leland-Gifford drill heads mounted radially on a rigid table, making it a simple matter for a single operator to move the work from station to station*

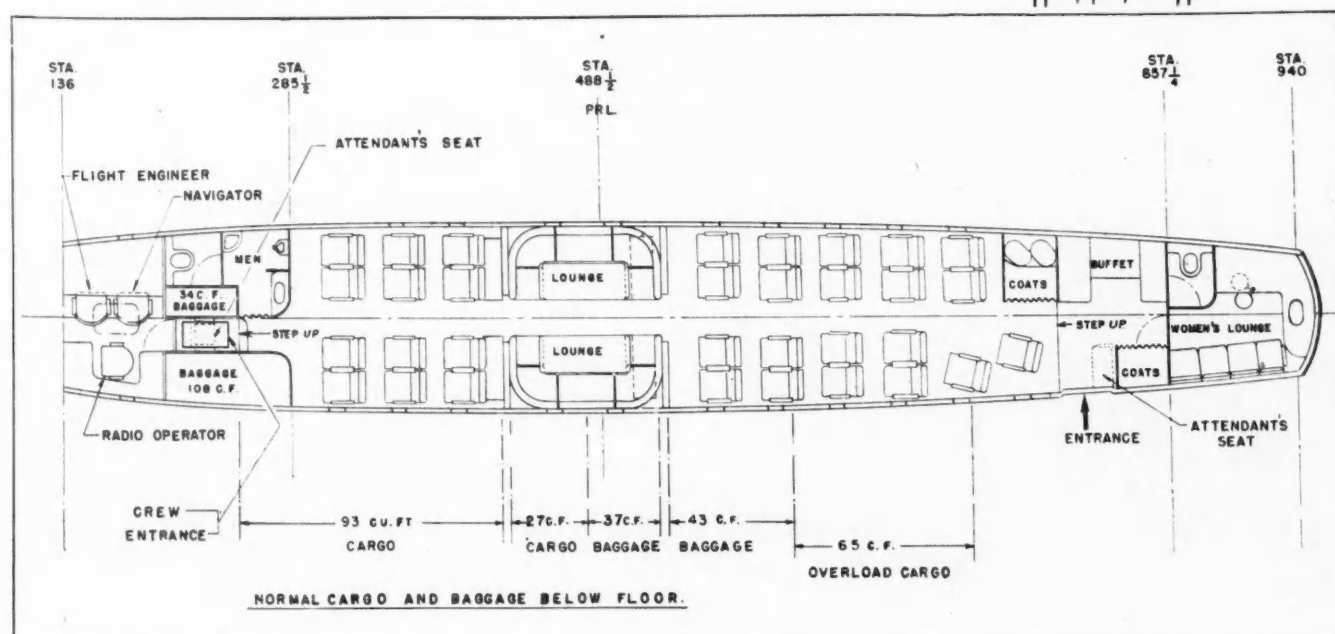
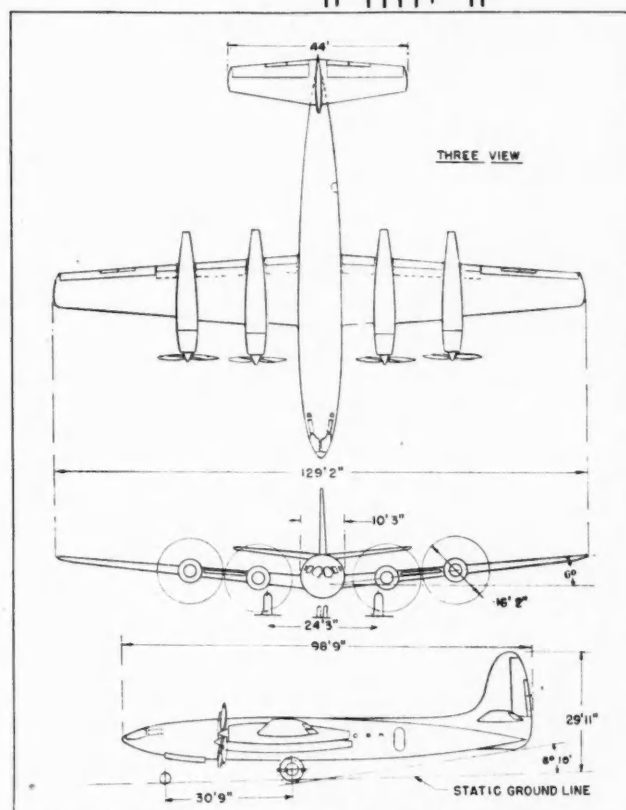


# Republic's RC-2

## Stratospheric Liner

REPUBLIC AVIATION CORP. has announced specifications for the Rainbow Clipper airliner (RC-2) to be built for Pan American World Airways. Delivery of the first six planes now on order is scheduled to take place within 22 months. Completely equipped for Pan American service a Rainbow Clipper will cost approximately \$1,250,000. As designed for transcontinental or transoceanic service at 40,000 ft, the cabins will be fully pressurized and air conditioned, and will have accommodations for 40 passengers and crew, in addition to mail and other cargo. Their engines will be turbo-supercharged, with provision made to utilize exhaust jet thrust. Specifications of the Rainbow Clipper follow:

Span	129.17 ft
Length	98.75 ft
Overall height	29.92 ft
Maximum fuselage diameter	10.25 ft
Wing area	1640 sq ft
Weight empty	66,980 lb
Take-off gross weight	113,250 lb
Payload for 4150 miles range	10,000 lb
Passenger capacity	40
Crew number	Seven
Cargo capacity	1,200 lb
Fuel capacity	5570 gal.
Engines	4 Pratt & Whitney Wasp Majors 3250 bhp each
Take-off power	450 mph
High speed at 40,000 ft.	over 400 mph
Cruising speed at 40,000 ft.	1680 fpm
Rate of climb at sea level	320 fpm
Rate of climb on two engines	4150 mi
Range (with no reserve)	41,000 ft
Service ceiling	4300 ft
Take-off distance over 50 ft obstacle	3000 ft
Landing distance over 50 ft obstacle	95 mph
Stalling speed	



# Motor Car Prospects

**I**N A world hungry for transport, whether it be for commercial or private use, automobile developments are a popular topic of conversation these days. Personal mobility has been so hedged in with restrictions, controls and exhortations to stay-put, that this can be regarded more as a form of escapism than of selfish thinking.

To the manufacturer of British motorcars, however, the theme is a very much more serious one. Now that the war has been won he is faced with an immediate demand for his products and he has not been allowed very much time in which to prepare his plant

for the rush of eager buyers. It seems, therefore, that for a considerable time after the cessation of hostilities the only British cars that will be made will be those which the manufacturer was selling before the war, or those which he had in advanced development stage when the fighting began.

What I would call the real postwar cars will take perhaps two to two-and-a-half years to get into the hands of the private owner. However, I think they will be worth waiting for, and a word or two about the developments which will influ-

## British Car Prices for 1939 and 1946

*Purchase tax in 1939 was 15 shillings per hp. Basic price is price of car at the factory.*

Make and Model	Basic Price		1946 Price Including Purchase Tax			
	1939 £	1946 £	£	s	d	
<b>Austin</b>						
Eight 4-dr deluxe saloon		255	326	0	0	
Ten 4-dr deluxe saloon	185	310	397	0	0	
Twelve 4-dr deluxe saloon	225	415	531	0	0	
Sixteen 4-dr deluxe saloon	245	445	569	0	0	
<b>Citroen</b>						
Light Fifteen Saloon	208	448	573	3	11	
<b>Ford</b>						
Anglia 8-hp Saloon	115	229	293	7	3	
Prefect 10-hp Saloon	145	275	352	2	9	
Prefect (leather upholstery)		281	359	16	1	
<b>Hillman</b>						
Minx Saloon deluxe 10-hp	175	310	396	17	3	
<b>Humber</b>						
Hawk 14-hp						
Pullman 27-hp	750	1250	1597	19	5	
Snipe 15-hp	355	675	863	5	0	
Super Snipe 27-hp	385	695	888	16	1	
<b>Jaguar</b>						
1½-liter 14-hp	298	535	684	7	3	
1½-liter (Special Equip.)	318	570	729	1	8	
2½-liter 20-hp	395	695	888	16	1	
3½-liter 25-hp	445	775	991	0	7	
<b>M.G.</b>						
Midget TC model	222	375	479	18	4	
<b>Morris</b>						
Eight Saloon (fixed-head)	139	235	301	0	7	
Eight Saloon (sliding-roof)	149	245	313	16	1	
Ten Saloon (fixed-head)	175	295	377	13	11	
Ten Saloon (sliding-roof)	185	305	390	9	5	
<b>Riley</b>						
1½-liter	310	555	709	18	4	
<b>Rover</b>						
Ten	275	460	588	10	7	
Twelve	300	505	646	0	7	
Twelve Sports Saloon	310	520	665	3	11	
Fourteen	330	550	703	10	7	
Fourteen Sports Saloon	340	565	722	13	11	
Sixteen	360	580	741	17	3	
Sixteen Sports Saloon	370	595	761	0	7	
<b>Standard</b>						
Eight Saloon	129	245	313	16	1	
Eight Tourer	125	235	301	0	7	
Eight Drophead Coupe		275	352	2	9	
Twelve Saloon	205	375	479	18	4	
Twelve Drophead Coupe	245	395	505	9	5	
<b>Sunbeam-Talbot</b>						
Ten Saloon	265	485	620	9	6	
Ten Coupe	225	520	665	3	11	
Ten Tourer	250	455	582	2	10	
2-liter						
<b>Vauxhall</b>						
Ten deluxe Saloon	182	290	371	6	1	
Twelve deluxe Saloon	198	315	403	5	0	
Fourteen	230	375	479	18	4	
<b>Wolseley</b>						
18/85 Saloon	325	530	677	19	6	

Note: At the time of this writing prices of the following British makes had not been announced: Alvis, Armstrong-Siddeley, H. R. G., Jewett Javelin, Lagonda, Lanchester, Lea-Francis, Morgan, Singer and Triumph.

By Sir Miles Thomas, D.F.C.

Vice Chairman, The Nuffield Organization

# in Britain

ence their size, shape, performance and finish may prove interesting.

In the main, I think British cars will generally be of medium-power. That is to say, the most popular will be in the horsepower range between the "Eight"

power it would take to propel a vehicle of similar size into which these principles had not been built.

I have already said that engines will be more efficient, a process which will be accentuated by the advantage we shall take from making the best provisions for full utilization of the developments made in high octane fuels during the war years. Lubricants, too, of much greater "oiliness" and affording a tougher film to resist wear, should be available to the postwar owner of our products. For those who want to go that little bit faster, then our postwar models should really have something to offer, and acceleration will be of an order which may surprise owners who think in terms of 1939 standards.

Chassis-less construction, of course, is predicated by the advances which have been made in this field of design. Monopiece body manufacture is bound to be the order of the day. In particular, I am sure we shall see striking progress in suspension systems. The torsion-bar and coil-spring types with which we have had so much experience

during this war are likely to rival those which did duty on our big prewar cars. Suspension, of course, is a matter of the greatest importance if we are to take a big share in overseas export markets.

There is quite a list of interesting developments which we may see investigated in the postwar period. Research into the use of plastics, light alloy sheets and forgings, and tougher steels, for example, will rank high in this work.

Take the problem of the plastic body. Already we know it should be more quiet to ride in because the material from which it is made is less resonant than steel panels. It is very attractive to think that it can be molded into intricate shapes and curves, with the attachment points for upholstery, instruments, radio, seat fittings and air-conditioning gadgets, fashioned into the main structure. But there are a number of very real technical difficulties to be overcome before we can really say that plastics have arrived in automobile body construction.

It must not be forgotten, either, that to date no intensive pre-production work has been done to enable costs of molded plastic automobile bodies to be assessed. One thing is certain, and that is the amount

(Turn to page 100, please)

## BRITISH PASSENGER CAR PRICES

Prewar

Postwar

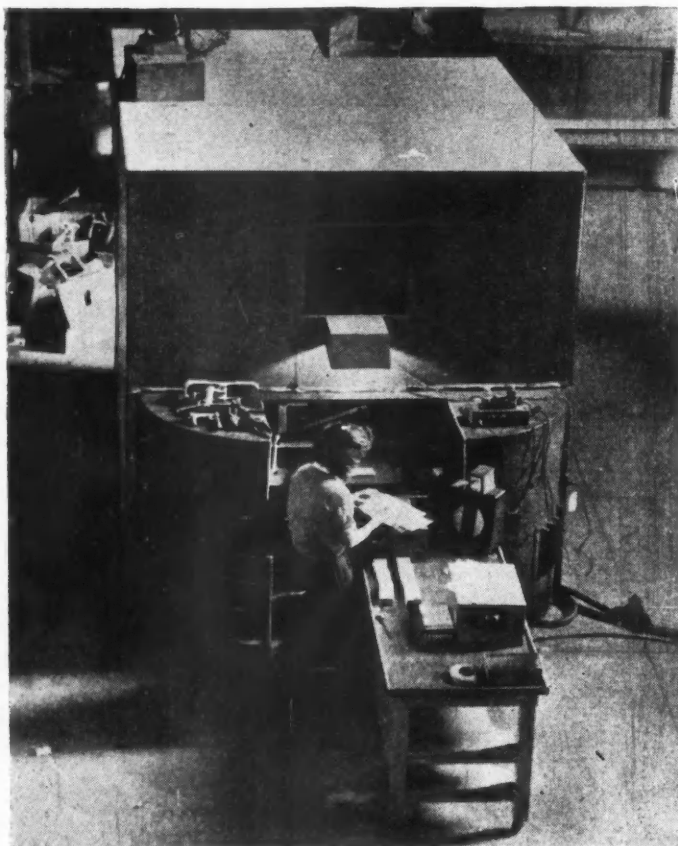
**A**S will be seen from the accompanying table, the postwar list prices of British passenger cars so far announced are from 70 to 115 per cent higher than the prewar prices of corresponding models. It should be remembered, in considering these prices, that to them must be added a purchase tax of 28 per cent, a levy on the automobile buyer which the present British Labor Government has seen fit to continue. The fact that British manufacturers have been compelled to increase their prices so drastically, coupled with the further fact that British workers in manufacturing establishments, in spite of their wartime raises, receive wages which are less by almost 60 per cent than those paid to corresponding American workers, makes clear the absurdity, barring all other considerations, of any appeal to the British Government to intervene in a wage and price dispute between a union and a manufacturer in this country.

and the "Fourteen." Britain, even in normal times, is a highly taxed nation, and one, moreover, which has to depend entirely on overseas resources for its automobile fuel. Economy of running, therefore, is a very potent force in the decision to purchase, and has led to the development of the relatively small but highly efficient engines for which this country is famed.

When our system of car taxation is changed from the old RAC horsepower rating to one of Cubic Capacity, we shall be given the opportunity of producing a much more square type engine which will give us a greater power output and added strength without any increase in overall size or weight. We can regard this as a valuable aid in our desire to increase motive power and yet not reduce the amount of room which we consider essential to the comfort of passengers. It is obvious, too, that an even greater degree of reliability will be obtainable from engines of this type.

There can be no doubt at all, after the lessons we have learned in this war, that streamlining principles will be increasingly applied to our automobiles. Streamlining in its truest sense is impracticable of attainment in automobile design, but we can get very near to it by what I would call "smooth-lining"; and by doing so we can easily save some 10 per cent of the





**Fig. 1—The portable fluoroscopic unit. Exterior view showing loading position and inspection room.**

**F**OR ultimate sensitivity of flaw detection in castings it has been popularly recognized that fluoroscopy runs a poor second to radiography. Accordingly very large volumes of radiographic film, especially for the examination of light alloy aircraft castings, have been used in the last few years. The investigations here described were undertaken at California Institute of Technology for the Office of Production Research and Development of the War Production Board. The purpose of this investigation was to determine more precisely the limitations of fluoroscopy, the possibilities of improving fluoroscopy, the possibilities of substituting fluoroscopic examination for radiographic methods in certain types of inspection, and the possibilities of extending the scope of fluoroscopic inspection methods to parts which cannot be economically radiographed. It may be pointed out that these investigations have shown that some of the popular notions of fluoroscopic performance and limitations are not entirely correct.

When this investigation was started there were

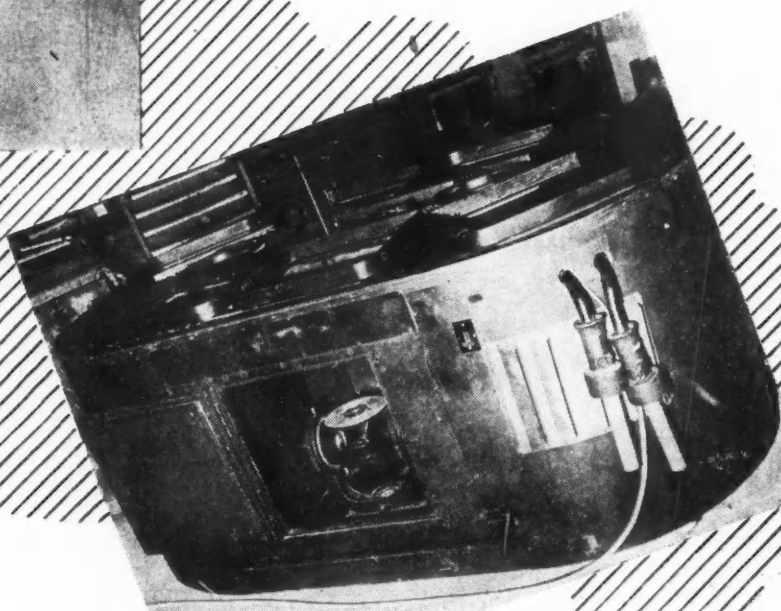
# *An Investigation* **Fluoroscopy**

**By B. Cassen**

Research Engineer,

**and D. S. Clark**

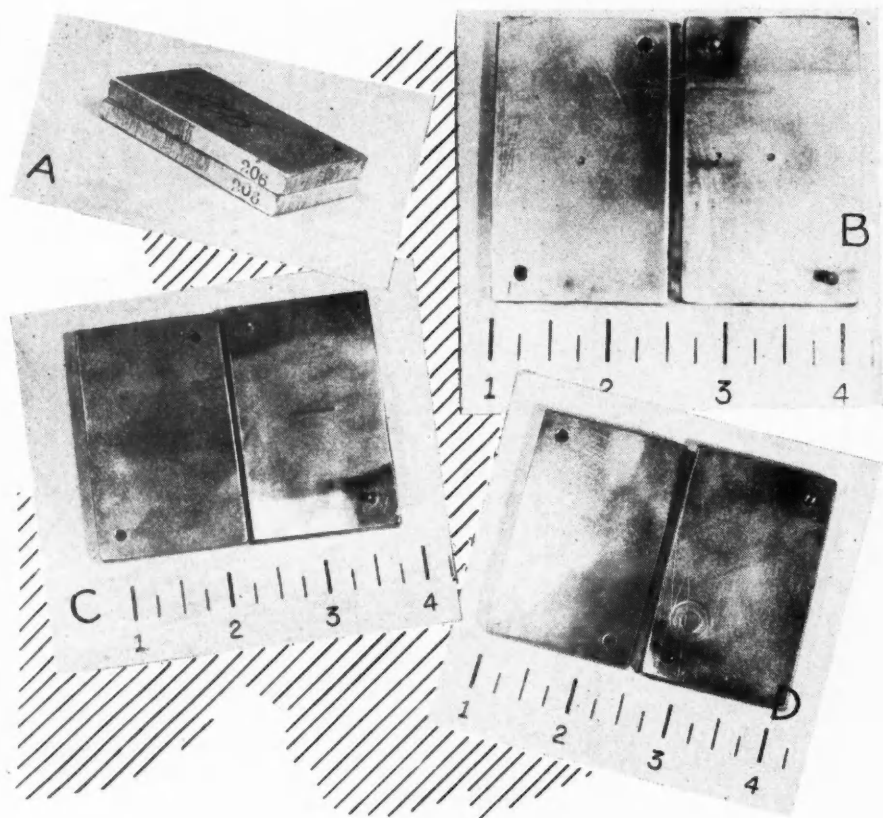
Assoc. Prof. of Mech. Eng.,  
California Institute of Technology



**Fig. 2—Arrangement of the X-ray tube head in a lead-lined box beneath the conveyor of the portable fluoroscope.**

industrial fluoroscopes in use and for sale, but they were not readily available for delivery at that time. For preliminary tests a fluoroscopic unit similar to some of the commercial types was constructed using a Westinghouse 140 kvp industrial X-ray unit as a basis. The conveyor and viewing arrangement was made somewhat similar to that used on a General Electric commercial model. Figs. 1 and 2 show the arrangement used. Conveyor trays on an endless chain carried specimens through a lead lined tunnel over the X-ray tube. The observer in a dark room examined the screen by looking downwards at a horizontal screen over the specimens. The conveyor trays

# of the of Light Alloy Castings



**Fig. 3—Test Specimens with artificial defects.**

A—Artificial specimen consisting of a sandwich of two flat blocks of 3 SO aluminum alloy.

B—Spherical cavities at center of interface.

C—Long cylindrical cavities at center of interface.

D—Flat washer-shaped cavities near corner of interface.

could be moved at a speed variable from stop to 20 fpm at the operator's choice. The protective window was the customary one in. thick packet of lead glass, treated to reduce surface reflections. The X-ray tube with a 2.4 mm focal spot was operated at a voltage of 140 kvp and with a tube current of 8 ma. In the preliminary tests the tube was placed so that the focal spot was about 20 in. from the tray bottoms.

This equipment was installed temporarily in a few foundries where a large number of castings of various types were examined. The following experiences were quickly attained:

1. All observers on all types and thicknesses of castings preferred to operate the equipment at the highest voltage available, thereby attaining highest screen brightness.

2. It is desirable to have the viewing window adjustable so that it may be moved toward the screen to get a "closer look" at defect images from small castings.

3. Extreme dark adaptation of the observer leads to an uncomfortable "glare effect" from unmasked areas of the field. Perfect masking is impractical except in very unusual circumstances. Better results are attained with partial dark adaptation to the illumination level of the screen. A proper level of illumination in the dark room is more comfortable than none at all.

4. It is desirable to have only one casting in the field of view at a time. If several castings are put on a tray simultaneously, the

reliability of visual scanning is reduced.

5. Continuous motion of the screen image across the field of view reduces a tendency toward a form of eye fatigue in which the observer sees "spots." The apparent motion produced by observing a stationary image with a manually moved low power magnifying glass also reduces the tendency to see spots.

6. On account of the large number of uncontrollable variables involved it seemed almost impossible to get any fairly reproducible and quantitative measure of fluoroscopic performance from this preliminary investigation.

## Artificial Samples

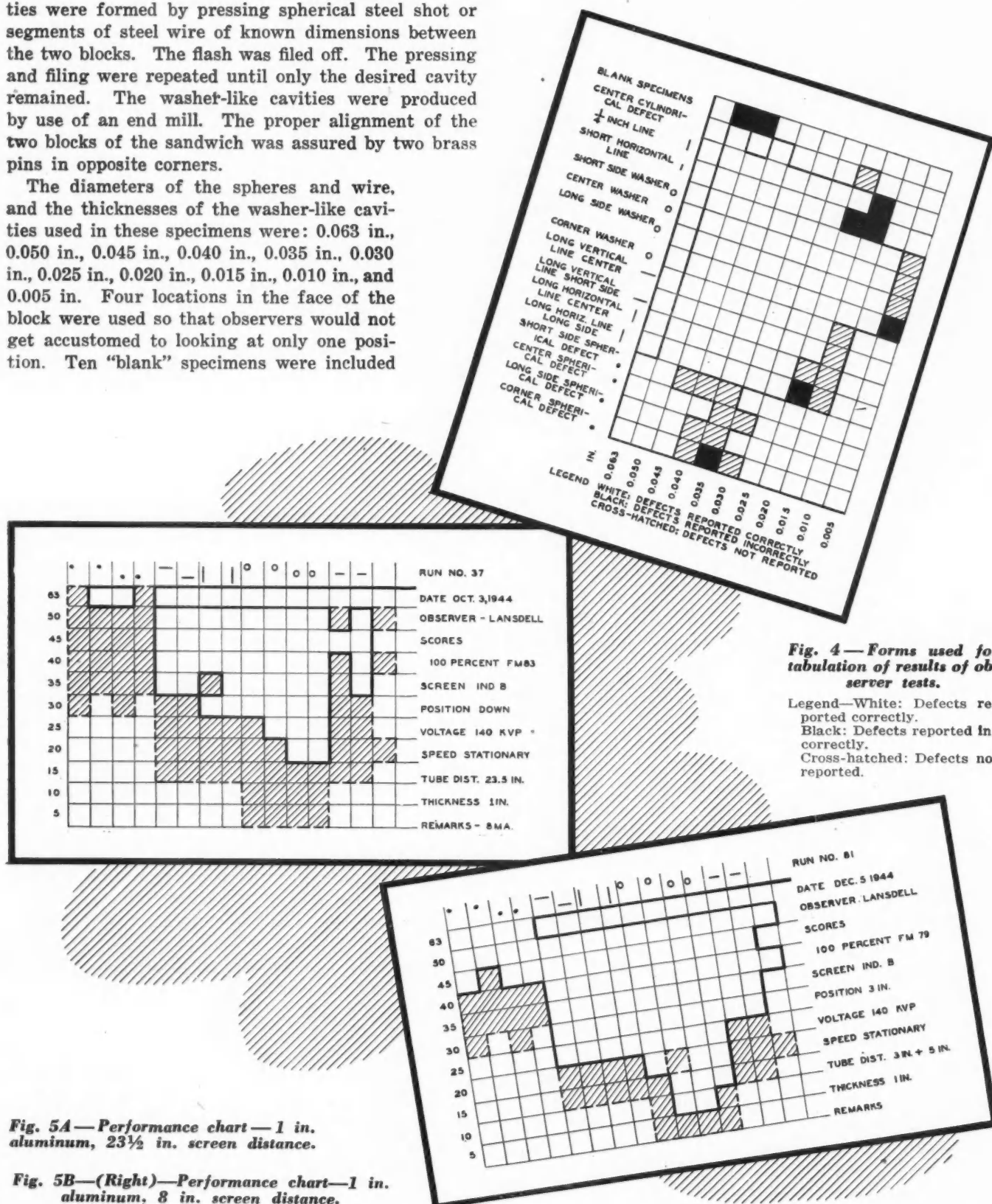
After these preliminary experiences it seemed that the only way to get a quantitative statement of fluoroscopic performance was to examine a series of artificially simulated defects of known sizes under carefully controlled laboratory conditions. The artificial specimens used in these tests consisted of sandwiches

of two flat blocks of 3-SO aluminum alloy, each block being 2½ in. long, 1½ in. wide, and ¼ in. thick. The total thickness of each specimen was ½ in., to which any desired additional thickness of aluminum sheet could be added. Artificial defects, in the form of spherical cavities, long cylindrical cavities, and flat washer-shaped cavities, were introduced at the interface between the two blocks of each sandwich as shown in Fig. 3. The spherical and long cylindrical cavities were formed by pressing spherical steel shot or segments of steel wire of known dimensions between the two blocks. The flash was filed off. The pressing and filing were repeated until only the desired cavity remained. The washer-like cavities were produced by use of an end mill. The proper alignment of the two blocks of the sandwich was assured by two brass pins in opposite corners.

The diameters of the spheres and wire, and the thicknesses of the washer-like cavities used in these specimens were: 0.063 in., 0.050 in., 0.045 in., 0.040 in., 0.035 in., 0.030 in., 0.025 in., 0.020 in., 0.015 in., 0.010 in., and 0.005 in. Four locations in the face of the block were used so that observers would not get accustomed to looking at only one position. Ten "blank" specimens were included

in each run. In order for the observer to score correctly he had to report not only the nature of the defect but its position in the block (such as corner, center, edge, etc.).

Results were tabulated for each test run on a form shown in Fig. 4, where the columns indicate the type





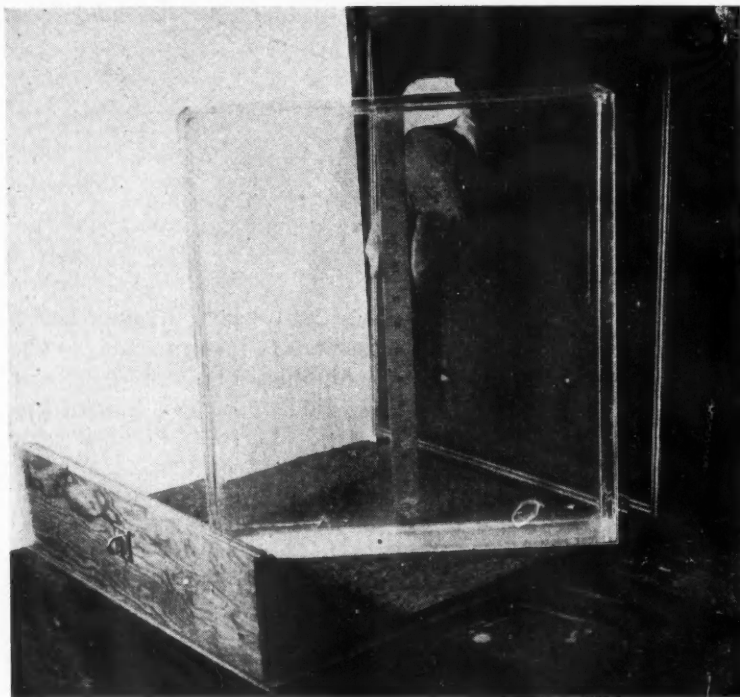


Fig. 6—Viewing cell.

and location of the defect, and each succeeding row indicates successively smaller thicknesses of defect. Correct identifications are shown on these charts as white squares, incorrect identifications as black squares, and defects unobserved as crosshatched squares. A scoring method was used in which a relative figure of merit was derived as the product of a sensitivity score and a reliability factor. The sensitivity score was determined by the percentage of the total number of defects identified correctly. The reliability factor was determined by the percentage of the total number of reported defects (not including blanks) which were reported correctly.

These tests were made with many observers under various controlled conditions, such as total thickness of specimen, speed of tray motion, distance of X-ray tube from tray bottoms, distance of screen from specimens, etc. Most observers had no previous experience. Three or four, however, including an experienced film reader, became experienced fluoroscopic observers during the course of this investigation. The more significant findings as the result of these tests are as follows:

1. It is entirely improper to assign a blanket "percentage sensitivity" to fluoroscopy. The percentage thickness of cavity reliably detectable is a function of area of the cavity, thickness of the specimen, rate

of thickness transition at the boundary and other factors not well defined. Spherical cavities are much harder to pick up than long cylindrical cavities of the same diameter. The long cylindrical cavities in turn are much harder to detect than a washer-like cavity of thickness equal to the cylindrical diameter. Drilled holes of both diameter and length equal to the diameter of a spherical cavity with which they are compared are more visible than the sphere when the axes of the drilled holes are in the direction of the X-ray beam but are not more visible when the axes are appreciably inclined to that direction. However, very small drilled holes are not more visible than the spherical cavity even when their axes are in the direction of the beam. This is understandable if it is assumed that a sharp boundary to the image makes it more visible, but that very small images cannot have a rela-

tively sharp boundary on account of the grain of the screen.

The percentage sensitivity becomes smaller—i e., improved—with increased total thickness of the specimen. Up to thicknesses of 1 in. of aluminum the absolute sensitivity decreases with thickness in such a way that the percentage sensitivity improves almost, but not quite, in proportion to thickness.

2. Despite the geometrical distortion and penumbra unsharpness due to the size of the focal spot of the tube, a spectacular increase in test score is obtained by putting the focal spot about five in. from the tray bottoms instead of 20 in. In these tests the screen

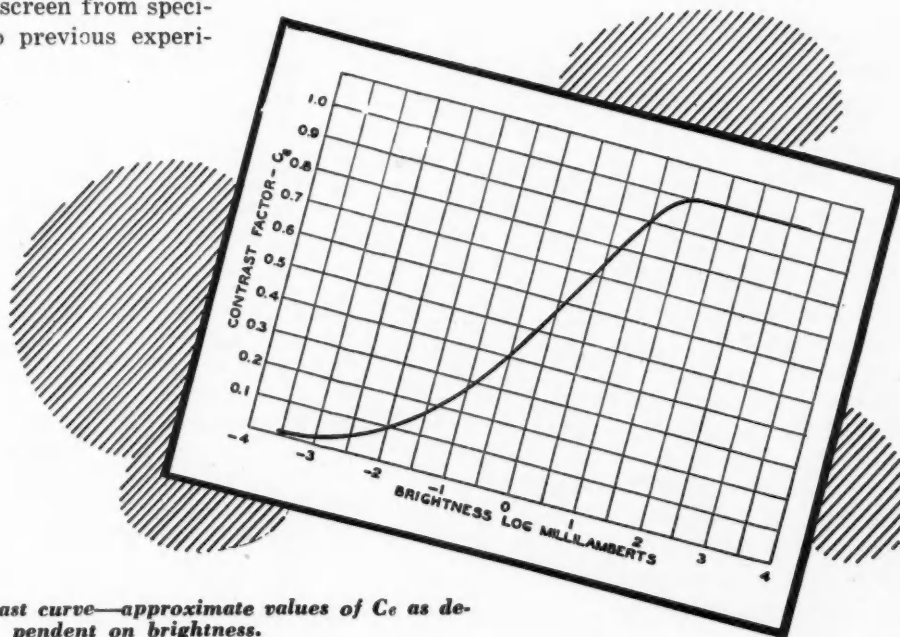


Fig. 7—Eye contrast curve—approximate values of  $C_c$  as dependent on brightness.

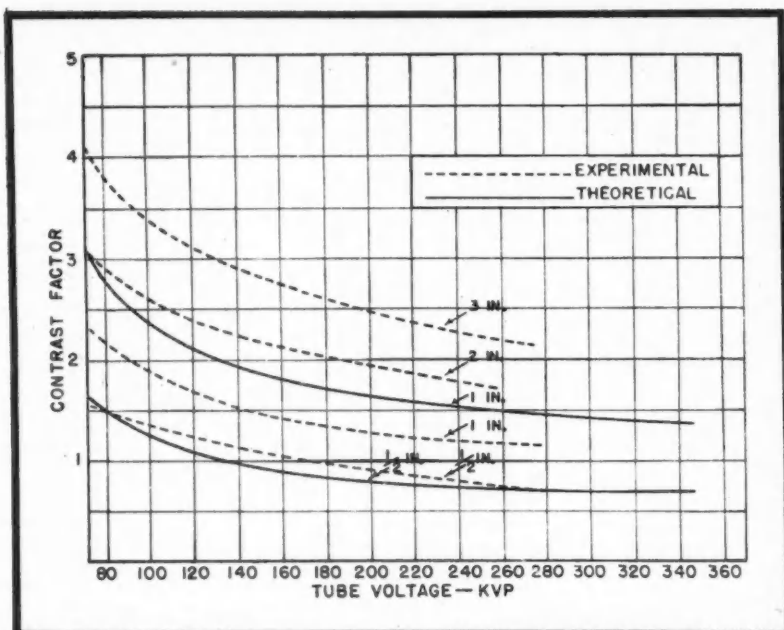


Fig. 8—Experimental and theoretical values of  $C_x$  for aluminum.

was three in. above the tray bottoms so that the range of focal spot-screen distance was from eight in. to 23 in. A decrease of focal spot-screen distance over the range increases the screen brightness by a factor of  $\left(\frac{23}{8}\right)^2 = 8.3$ . With this increased screen brightness, only slight dark adaptation is required for comfortable viewing. There is no appreciable glare effect from unmasked areas, thereby making intricate masking methods unnecessary. The effect of "seeing spots" also seems to disappear unless the observer strains his imagination to the limit or becomes appreciably fatigued. Fig. 5 shows a typical comparison of test charts for long and short distances.

3. Under any set of viewing conditions it takes the observer as much as one min. to determine whether or not he really sees defects near the limit of resolvability. If his time is limited his performance on these limiting defects becomes very erratic.

#### Protective Window

In order to take full advantage of the greatly increased screen brightness attained by placing the tube a short distance from the work piece, it is necessary to abandon the use of lead glass as a protective window. When lead glass is exposed to X-rays of the intensity utilized in short distance fluoroscopy it rapidly turns brown. In fact, under these conditions crude images of the castings are formed in the lead glass. They fade, but leave a residual coloration which is hard to remove by heating of the lead glass. Coincident with the

initial field tests with the fluoroscope an attempt was made to find a substitute for the lead glass. A substitute was finally developed in the form of a plastic (Lucite) cell filled with a nearly saturated aqueous solution of lead perchlorate. Such a cell having a thickness of three in. of lead perchlorate solution is approximately equivalent to one in. of lead glass or  $\frac{1}{4}$  in. of metallic lead. The appearance of one of the cells is shown in Fig. 6. X-rays seem to

have no effect whatever on these cells. The solution and plastic have roughly the same refractive index, hence there is no surface reflection between them. If the thickness of the cell is an appreciable part of the total viewing distance, the foreshortening caused by the solution has the effect of an apparent magnification of a number of diameters equal to the refractive index of the solution. One of these cells was used as a viewing window during the tests with the series of artificial specimens.

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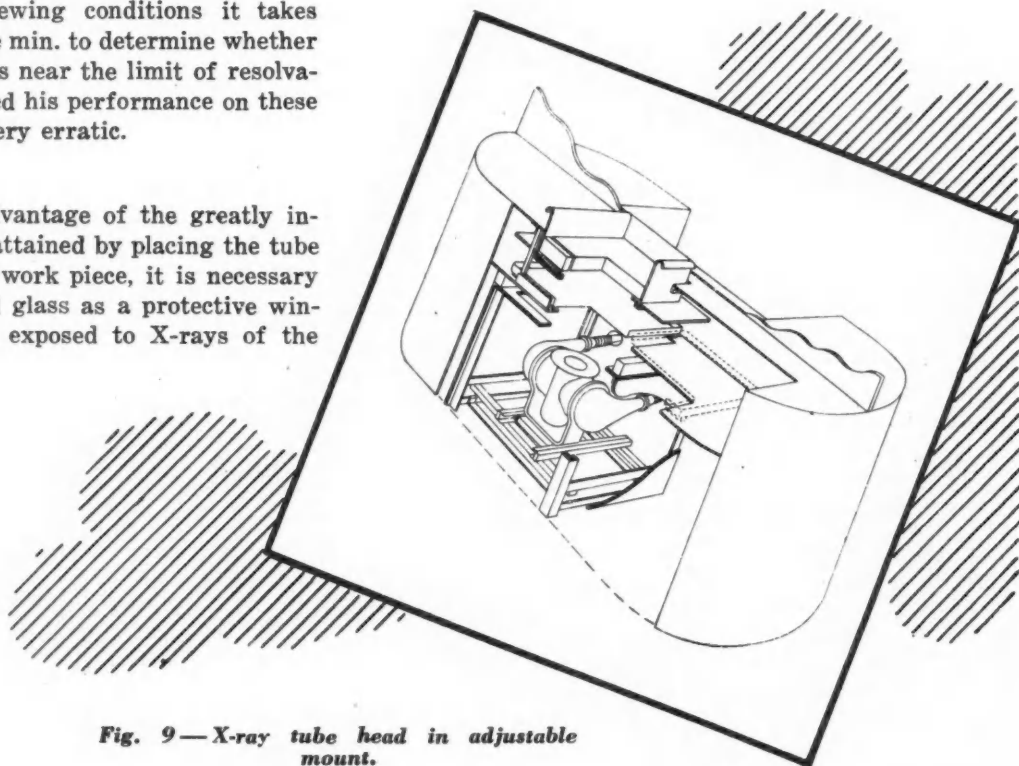


Fig. 9—X-ray tube head in adjustable mount.

## Reconverting Production Thinking to Peacetime

# Cost Consciousness

NEARLY everyone is aware of the fact that most plants that have been engaged in war goods production must be retooled in order to be suitable for peacetime uses. It is accepted that many efficient wartime plants will be useless for peacetime activities. But few realize that a similar situation exists in connection with production men. The thinking and habits of many production managers must be reconverted or they, too, will be unsuited for peacetime operations.

It would be unreasonable to expect production men to retain their prewar cost consciousness when for several years almost the entire emphasis has been upon "more output—and let the costs fall where they may." One must also remember that a considerable portion of postwar production men will be made up of younger men who had little or no prewar experience in this type of work and thus have no backlog of cost consciousness to fall back on. To be required to think in terms of cost instead of volume is going to be a real conversion problem for these men.

Even more difficult, and important, is going to be the necessity for realizing that postwar cost factors are not going to be the same as those of the prewar years. During the war several changes occurred which will undoubtedly affect postwar production costs. Several of these should be studied carefully by production men so that they may understand them thoroughly and take them into account in their postwar work. These are:

- a. Increased wage rates.
- b. The necessity for a greater postwar national income.
- c. A greater number of jobs in the postwar period than existed in the prewar period.
- d. Greatly expanded plant capacity.
- e. Increased use of expensive tooling.

Actually, these are not separate and unrelated changes. Instead, they are very definitely related. They all point toward the necessity for large scale production of goods under highly competitive conditions, at low unit costs, while still maintaining high wage levels.

It is apparent that postwar wage rates will not go back to prewar levels. In order to obtain low total unit costs there will be a great amount of attention given to methods of reducing unit labor costs. This can be done by utilizing workers more efficiently or by further mechanization. The results of these two are not the same.

The condition which exists in the relation between total unit costs, unit labor costs and unit overhead costs is illustrated in Fig. 1. Industry has attempted to reduce total unit costs continuously. When this is done by mechanization, unit labor costs are de-

creased but unit overhead costs are often increased. As long as the increase in unit overhead cost is less than the decrease in unit labor cost, the result is satisfactory. But the fact that the ratio of overhead costs to labor costs is increasing is not appreciated by all. The significance of this fact must be realized by postwar production men. When investment in new equipment is required, unit overhead costs tend to rise unless the new equipment is highly productive and is operated at maximum capacity. The possession of production equipment sets up the necessity for its utilization. As the ratio of overhead costs to labor costs increases, more and more attention must be given to

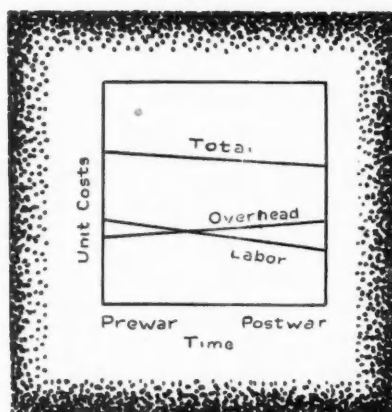


Figure One

productive machine time.

A study of a lathe in one plant resulted in the breakdown given in the first column of Table I. The figures were based upon the plant operating one eight-hour shift per day and were computed upon the basis of eight hours representing 100 per cent. These figures indicate that the productive machine time of this lathe is only 38 per cent. This low productive machine time is not at all unusual when compared with the machines in many shops. However, these values do not tell the entire story. They were based upon the assumption that this lathe was available for operation only eight out of the 24 hours in each day. Actually, this tool was available for use throughout the entire day. If the values for eight hours possible operation

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# Air Turbine Refrigeration Most Practical for

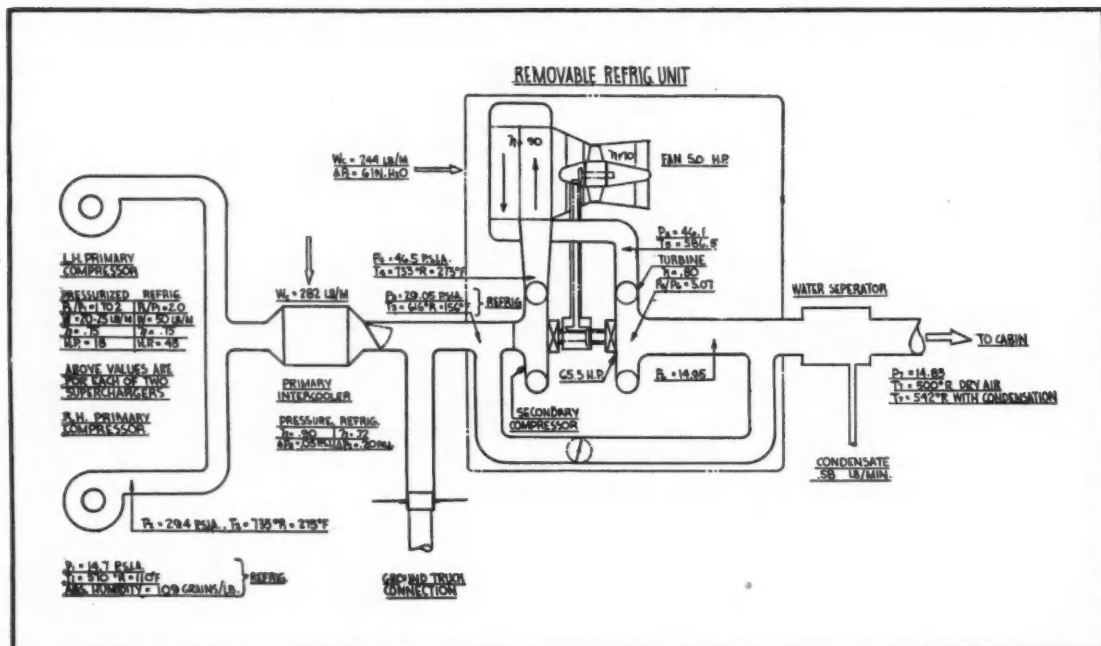


Fig. 1—Basic schematic diagram of the Constellation air cycle refrigeration system.

**R**EFRIGERATION, flight engineer station design, control decks, emergency equipment for over-water transport, airport terminal design, cargo handling problems, passenger cabin design, lighting and air navigation, all came in for their share of prominence at the SAE National Air Transport Engineering Meeting in December at Chicago. Another feature of the meeting was a talk on "Gas Turbines" by Dr. Sanford A. Moss, Consultant, General Electric Co. Kenneth Campbell, Wright Aeronautical Corp., was presented the Manly Memorial Medal for his paper, "Engine Cooling Fan Theory and Practice."

The technical papers presented had to do primarily with operations and design. Some of the more important aspects of the papers dealing mainly with design and construction are presented herewith.

Along the lines of passenger comfort was the paper, "Refrigeration for Air Conditioning Pressurized Transport Aircraft," by Bernard L. Messinger, Group Engineer, Thermodynamics, Lockheed Aircraft Corp. It is apparent that the overall control of passenger comfort depends upon a variety of factors. Refrigeration influences two of them—temperature and hu-

midity. Without adequate control of these two, the effect of other items like ventilation, cabin pressure, noise level and others is greatly diminished.

Fig. 1 illustrates the functional arrangement of an air-turbine system for the Constellation. All of the refrigeration equipment is contained in a single removable unit which requires no external connections other than those at the air inlet and outlet. No power is supplied to the unit by mechanical or electrical means. Power enters the system only through the cabin superchargers. These superchargers are no larger in capacity than if designed for pressurization alone. This is due to the fact that they are designed for high altitude inlet air density, and when operated at maximum speed at sea level they have the inherent capacity to supply the increased mass-flow required for maximum refrigeration. Obviously there is an increase in the power required under this condition at sea level, and the transmission design is based on this maximum requirement. All of the significant design quantities are shown in Fig. 1.

In order to meet the airline requirement to be able to cool the airplane on the ground in the absence of

# Cycle Pressurized Airliners

By B. M. Ikert

***Air Conditioning Equipment and Constellation Installation Discussed by Lockheed Engineer at SAE National Air Transport Meeting in Chicago. Design Problems in Connection with Flight Engineer Station, Control Deck, Instrument Standardization, Lighting and Decoration of Cabin Interiors Also Receive Considerable Attention.***

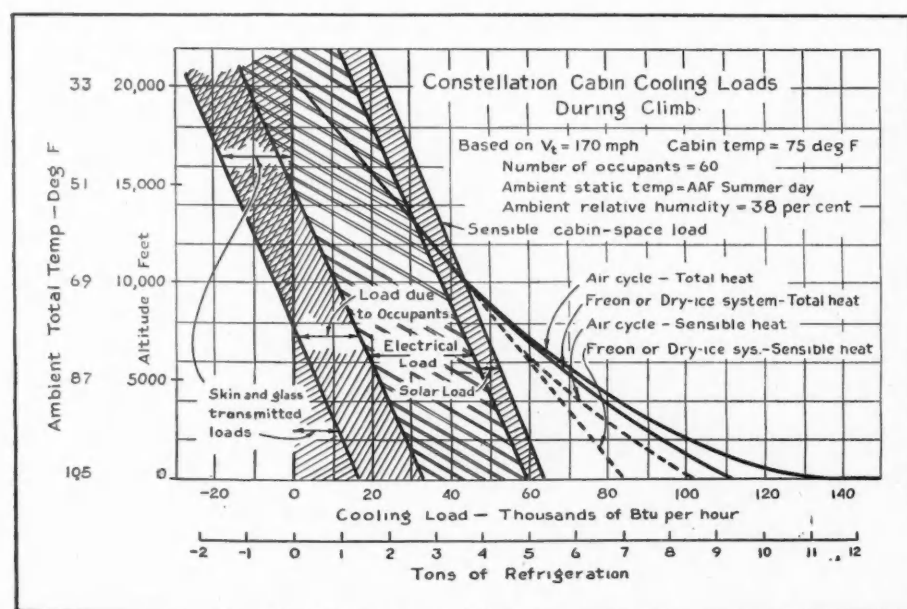
ram, the author suggested the application of the turbine power to both the secondary compressor and the coolant air fan as in Fig. 1. Before this it was common practice either to deliver the entire turbine power to the secondary compressor and depend only on ram air for cooling the aftercooler, or to wastefully deliver all the turbine power to an inefficient fan for supplying aftercooler coolant air, the latter fan acting more as an energy absorber than as a fan.

The water separator shown serves to remove about 60 per cent of the entrained free moisture which, under design conditions, is condensed at the turbine. The remaining 40 per cent will be evaporated during the process of mixing turbine air with circulated cabin air, thereby making this latent cooling capacity available as sensible cooling in the cabin. Control is accomplished by means of a simple bypass valve as indicated.

In the actual airplane installation air enters the

airplane through two flush scoops on the lower surface of each wing leading edge and is delivered to the primary centrifugal compressors located in the outboard nacelles. These are driven from the main engines through variable speed transmissions which permit the full refrigeration capacity to be obtained at engine speeds down to 1200 rpm. Although the transmission is not of the slip-pump type, a small oil cooler is required, and is located in the leading edge just inboard of each outer nacelle. The discharge air from both compressors is ducted to a single primary intercooler located in the trailing edge section of the right hand wing. The removable refrigeration unit is located adjacent to the intercooler. From this point an insulated duct takes the cooled air through the water separator and then into the cabin distribution system.

Fig. 2 shows the variation in cooling load with altitude during climb. The components of the cabin space load are indicated by the various shaded areas. The convergence of the overall load curves at 10,000 ft is the accidental result of the fact that at this altitude the required air flow rate through the superchargers is the same for the air cycle, dry ice and Freon refrigeration methods. Furthermore, the latent load becomes zero at this point and the temperature of the air leaving



**Fig. 2—Variation in cooling load with altitude during climb.**

**Fig. 3—Comparison of the significant installation and performance factors for Freon, dry ice and air turbine systems of aircraft refrigeration.**

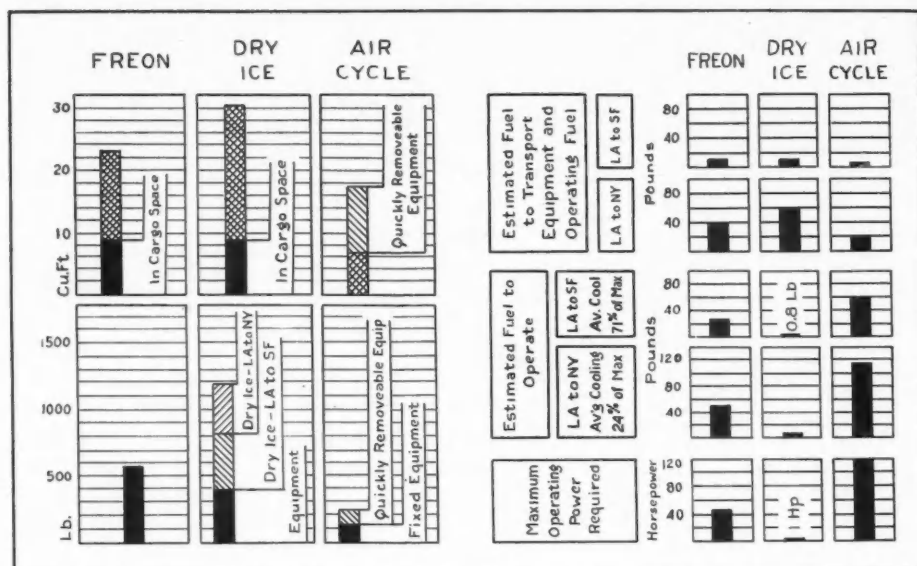
the primary intercooler is equal to the cabin temperature so that the total cooling load is equal to the space load.

Fig. 3 gives a direct comparison of the significant installation and performance factors for the three systems. It is apparent that the air cycle has a very definite advantage over the other systems when weight and space requirements are considered. From the standpoint of maximum power required, it is the least favorable of the three, although the duration of this maximum power load is short. As indicated in Fig. 3, the average cooling load for the Los Angeles to New York operation is only 24 per cent of the maximum. The corresponding average power required for the air cycle is 20 per cent of the maximum power. For the Los Angeles to San Francisco flight, the corresponding average values are 71 per cent of maximum cooling and 58 per cent of maximum power. The relative amounts of fuel required to operate the equipment as well as that to transport it are also shown. Of much more significance than the amount of fuel to transport the equipment is the relative sacrifice in airplane revenue which would occur in long-range operations whenever the payload is limited by the take-off gross weight of the airplane. No plot of this comparison has been shown, but it would be proportional to the weight of the equipment plus operating fuel.

#### Flight Engineer Station Design

The primary consideration in the design of a flight engineer station is the high standard of coordination which must be effected between the pilots and the engineer. So stated M. F. Vanik, Airworthiness Requirements Engineer, Boeing Aircraft Co., in his paper, "Flight Engineer Station Design and Requirements."

Probably the most feasible manner to provide such coordination is to locate the flight engineer in close proximity to the pilots, utilizing a common control panel, but such as not to interfere with the primary activities of the pilot and co-pilot. Indicating instruments, such as cowl flap position, fuel and oil pressure, fuel and oil quantity, temperature gages, and similar powerplant indicators, should be located on the main panel easily viewed by the engineer and co-pilot for double check. Fuel and oil selector switches, booster pump switches, generator voltage and current switches and indicators, starting, priming, cowl flap, and similar equipment which requires only a single



or infrequent check may be efficiently mounted on an overhead panel between the pilot and co-pilot, accessible to them but primarily operable by the flight engineer located directly between and slightly behind them. Landing gear switches, wing flap switches, propeller rpm, throttles, mixture controls, and similar equipment should be mounted on the aisle stand directly in front of the flight engineer for easy operation by him but also accessible to the pilot and co-pilot. Emergency hydraulic and electrical systems, circuit breakers, and other miscellaneous similar equipment should be mounted on side panels on the co-pilot's side of the airplane, conveniently accessible to the co-pilot and also easily operable by the flight engineer.

Mr. Vanik also stated that there has been a strong and uniform indication that the following arrangement procedures provide the best results for ease of operation and minimizing confusion:

1. Instrumentation or controls providing similar indications for each engine should be lined up horizontally.
2. Controls for each particular engine should be lined up vertically.
3. A color coding should be used to isolate the important groups of powerplant and flight instruments.
4. Controls for emergency operations, such as feathering of engines, should be lined up fore and aft or vertically in proper sequence of action required.

With the advent of six and eight engine airplanes, it is conceivable that cockpit functions can become very cumbersome. Developments have been proceeding for the past four years on a number of simplifications. These include:

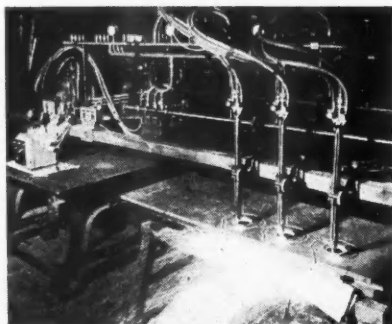
1. Automatic cowl flap mechanism for setting cooling and antidrag performance. Also, exhaust pumps which would eliminate conventional cowl flap operation look promising.
  2. Automatic fire extinguishing systems to shut off valves, shut off ignition, throttles, mixture control, feather the propeller, close cowl flaps and discharge
- (Turn to page 56, please)



# New Production Equipment

**A**N "ELECTRIC EYE" tracing device for pantograph type oxy-acetylene cutting machines that simplifies steel cutting operations has been announced by Air Reduction Sales Co., New York, N. Y. The new device, applied to machine gas cutting in collaboration with General Electric Co., will be known as the "Electronic Bloodhound." It completely eliminates metal and wood templates and all other mechanical or manual auxiliary guiding devices.

Electronically controlled tracing equipment cuts the most complicated shapes with precision from outline drawings or silhouettes of the desired piece. There are no limitations to the



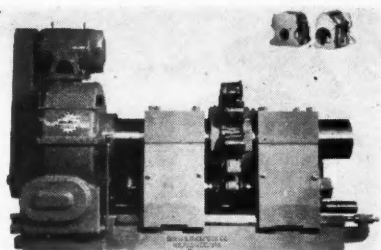
**Electronic tracing equipment installed on an Oxygraph cutting machine**

variety of designs which may be cut as the electronic tracing head is said to follow the most complex angles and curves with extreme accuracy.

A new field of application has been opened in machine production cutting through the "chain" method of reproduction made possible with this type of template. In this chain method, a series of identical shapes are drawn on the template and connected with a continuous line, making production cutting of several pieces possible in a single operation.

Electronic tracing equipment consists of two units—the tracing head and control box. All working parts are fully protected. This equipment is easily attached to any Oxygraph or Travograph cutting machine in place of conventional equipment.

**DAVIS AND THOMPSON CO.**, Milwaukee, Wis., has designed and built a No. 2-B Roto-Matic miller for continuous milling of the parallel faces of transmission cases. Work pieces are automatically clamped and located. Rotation of the work drum passes work



**No. 2-B Roto-Matic miller**

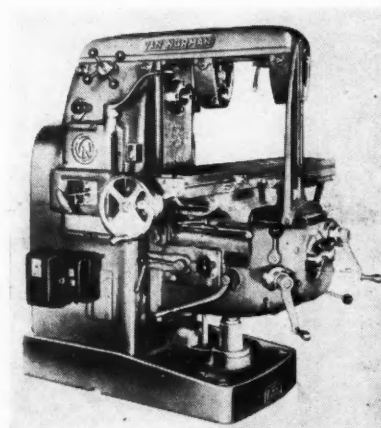
through the roughing cutters and through the finishing cutters successively. After a rotation of the work drum, milling operations are completed. The fixture drum has 12 stations insuring a continuous flow of pieces through the cutters.

To insure accuracy, a micrometer adjustment is provided for each spindle which is readily accessible from the outside of the heads. Both heads of the machine are movable on the ways providing flexibility of range. Speeds and feeds are controlled through change gears.

**L**AATEST addition to the line of the Van Norman Co., Springfield, Mass., is the No. 2 medium horizontal miller which is especially designed for milling applications of medium size and smaller parts.

Among the new engineering features is the Van Norman design which incorporates a heavy flywheel mounted on the spindle inside the column, assuring uniform transmission of power to the cutter.

The cutter spindle is mounted on large double-opposed Timken bearings

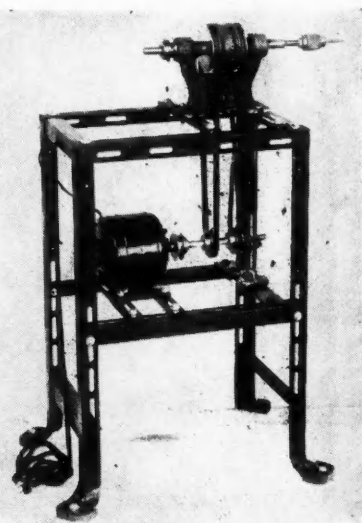


**Van Norman No. 2 horizontal miller**

in front and straight roller bearing in rear. Large precision gears are made of hardened alloy steel. Multi-splined shafts rotate on taper roller bearings.

The No. 2 medium has front and rear directional control of all power feeds. These controls are actuated in the direction of desired table, saddle and knee movement. Power rapid traverse also has front and rear controls. They provide finger-tip control from either the front or rear position.

**S**IMPLICITY is featured in the Star friction horizontal tapping machine offered by Samuel S. Gelber, Chicago, Ill. The Star friction drive consists of two specially treated rawhide leather discs. A slight pressure on the work and the back friction driving surface operates to start the tap into work—a slight pull on the work and front fric-



**Star friction drive tapping machine**

tion drive surface revolves faster to instantly reverse the tap.

A 3/4-in., three-jaw keyless chuck is furnished together with necessary belts, motor, toggle switch and 8 ft. of cord.

Note the method of mounting motor. Any make fractional horsepower motor can be used.

**B**ATTERY - POWERED resistance welders made by the Progressive Welder Co., Detroit, Mich., are now available with internally water-cooled storage batteries. The new Exide batteries developed exclusively for Progressive by Electric Storage Battery Co. of Philadelphia, Pa., are said to have an effective capacity several times that of conventional storage batteries when used in this service. Chief reason for this is the high charge and discharge rates permissible with the cooled batteries. This in turn makes possible increased output with fewer batteries, especially when welding aluminum and other metals or alloys requiring high fusion currents.

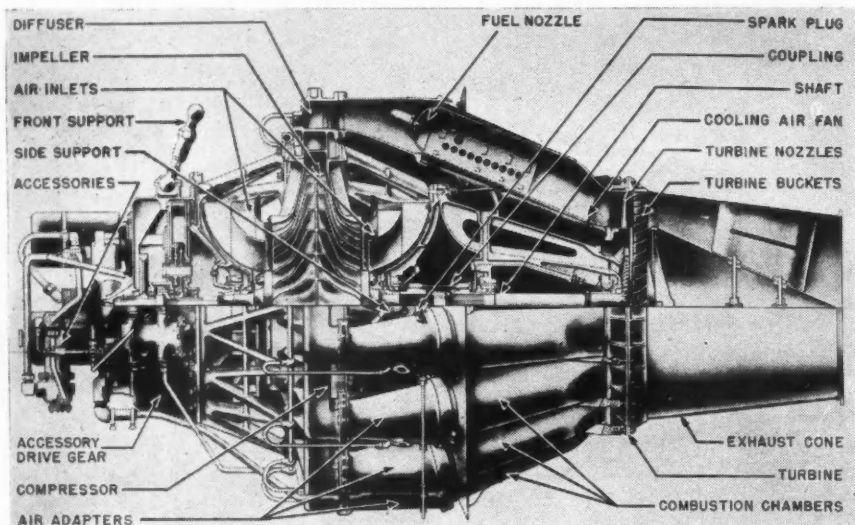


Fig. 1—Cutaway view of the I-40 engine.

**E**ARLY in 1943, at the request of the Army Air Forces, the General Electric Co. started the study of a jet propulsion gas turbine to have considerably higher rating than any jet propulsion gas turbine then in existence. At the request of Col. D. J. Keirn, Air Technical Service Command, and the Development Committee of the General Electric Engineering Division, the original design study was made of a gas turbine to have 3000-lb static thrust. This design was revised to a gas turbine with 3500-lb static thrust with the hope that development of the design in the future would allow an ultimate rating of 4000-lb thrust. In the latter part of May it was decided that the proposal would be made for a gas turbine with 4000-lb static thrust at sea level standard conditions. This proposition became known as the Type I-40 Jet Propulsion Gas Turbine, and on June 26, 1943, it was decided to proceed with this development.

Three months were spent completing the design and making drawings for the manufacture of the first development gas turbine. As soon as the drawing for each part was completed, work was started to produce it. Only six months later, in January, 1944, the first I-40 was completed and delivered to test. The first I-40 was run up to 8000 rpm on Jan. 13, 1944, just 6½ months after the start of the project. In subsequent tests this gas turbine was run at various speeds up to 8700 rpm, a limit observed because the buckets of the first turbine wheel had an unfavorable tilt and were not considered satisfactory for operation at higher speeds.

Complete performance data were finally obtained in a month, after a new turbine wheel had been installed and the following data were obtained. These data have been corrected to standard conditions of 14.7 psi and

## Development of the I-40

Table I—I-40 Gas Turbine Data

Impeller Diam.	30 in.
Impeller Inlet Diam.	18¼ in.
Impeller Hub Diam.	8 in.
Diffuser Throat Area	75 sq in.
Fuel Nozzle Size	40 gal per hr and 100 psi
Turbine Nozzle Area	121.3 sq in.
Turbine Pitch Diam.	22 in.
Turbine Nozzle and Blade Height	4 in.
Exhaust Pipe Diam.	21 in.
Jet Nozzle Diam.	19 in.
Maximum Over-all Diam.	48 in.
Over-all Length	101½ in.
Average Weight	1820 lb
Center of Gravity (Aft of Trunnion)	2 in.

59 F at the compressor inlet:

Speed	11,500 rpm	Exhaust Temp	1300 F
Thrust	4200 lb	Jet Diam	18.2 in.
Fuel Flow	5070 lb per hr		

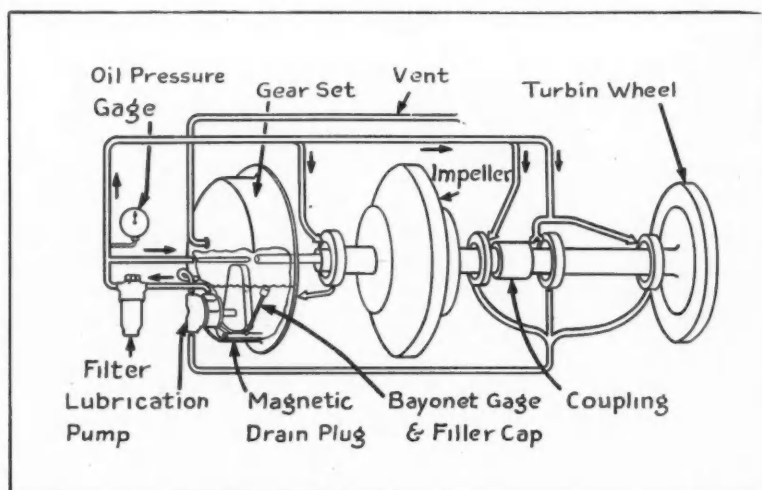


Fig. 2—Schematic drawing of the I-40 lubrication system.

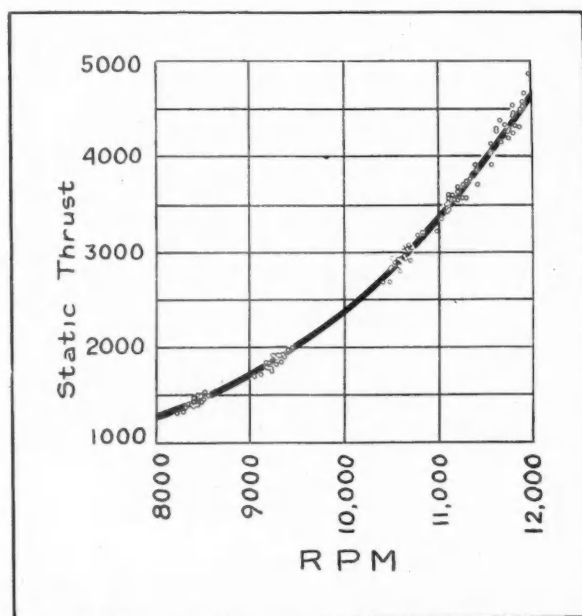
**By Dale D. Streid**

Aircraft Gas Turbine  
Engineering Division,  
General Electric Co.

# Jet Propulsion Gas Turbine

So far as was known at the time, 4200 lb was the highest thrust that had ever been obtained in a jet propulsion gas turbine. The performance data were very gratifying but the exhaust temperature was much higher than desired so the jet diameter had to be increased to 19 in. in order to keep the exhaust temperature below the desired limit of 1200 F.

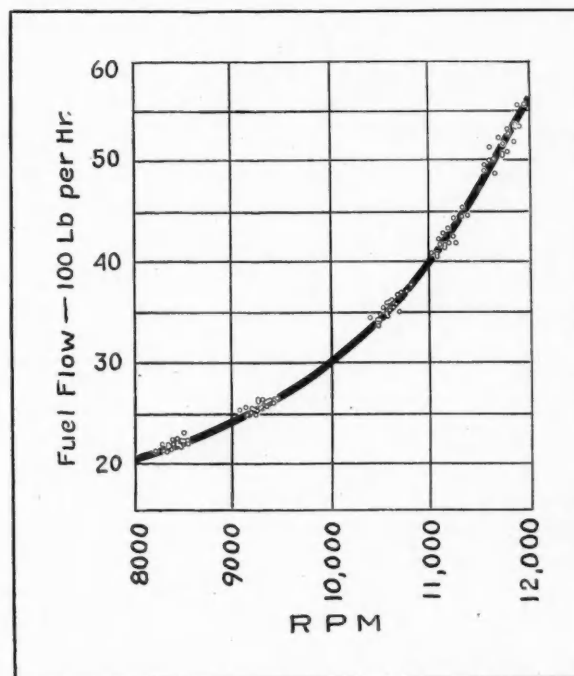
Additional developmental I-40 gas turbines were completed each month for the next three months. The



**Fig. 3—I-40 Performance Data (Units 20 to 40)—Thrust.**

first three developmental gas turbines have been used ever since for performance and endurance tests at Lynn and have never been used in airplanes for flight. The fourth I-40 was shipped to Lockheed at Burbank, California, after brief performance and operation tests, and it was installed in the first XP-80A airplane.

The first flight of the Lockheed XP-80A airplane powered by the I-40 gas turbine was made at Muroc, Calif., on June 10, 1944, less than a year after the start of the project. This flight was for about 30 minutes duration to an altitude of 10,000 feet and the operation of the I-40 was quite satisfactory. Since that time, a great number of flights have been made



**Fig. 4—I-40 Performance Data (Units 20 to 40)—Fuel Flow.**

by a large number of Lockheed P-80A airplanes using the I-40 as the power plant.

The development of the I-40 since the first flight of the P-80A has proceeded very rapidly. As would be expected with a power plant of such radically new size and design, many problems developed both as the result of factory testing and flight operation. Among the problems which required considerable development were: exhaust cone buckling, sticking of automatic controls, carbon formation, and fuel pump wear. These problems were brought under control and manufacture of the I-40 gas turbine proceeded to fundamentally the same design which was laid down during the summer of 1943. Many mechanical improvements have been made but no major redesign has been found necessary.

Fig. 1 shows a cross section of an I-40 gas turbine. Air enters the compressor through circumferential inlets on the front and back of a double-sided impeller. These inlets are covered with screen to keep large particles of dirt or stone from getting into the air intake. The air is turned into the annulus of the impeller by



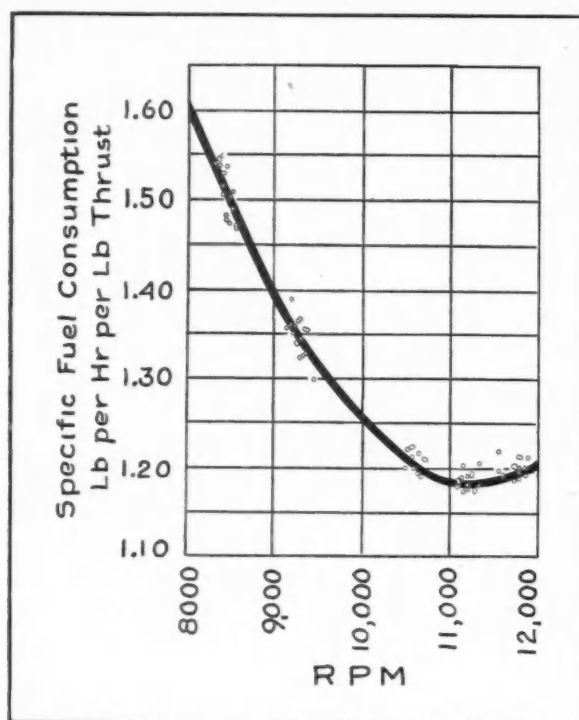


Fig. 5—I-40 Performance Data (Units 20 to 40)—Specific Fuel Consumption.

means of guide vanes and a single splitter vane. The design of the inlet does not impart any preswirl to the air as it enters the impeller. The impeller is a solid aluminum forging with milled blades, the inlet sections of which are bent to match the incoming air flow. The discharge from the impeller enters 14 equally spaced diffuser passages. At the end of each diffuser passage is a "Wirt" type elbow containing four turning vanes which turn the air 90 degrees into the compressor discharge.

The air from the compressor outlets is conducted to the combustion chambers by means of cast air adapters. These air adapters carry the fuel nozzles, the domes or end caps of the combustion chamber, and the spark plugs.

The 14 combustion chambers are of the through flow type with air entering from the compressor end and leaving at the turbine end in the same direction. The combustion is controlled by the holes in the liners and the outer tubes are cooled by the compressor discharge air before it enters the liners. A thin film of air travels the full length of the liners in order to provide cooling at the liner ends at the turbine inlet. Ignition during starting is obtained from two spark plugs mounted in the diametrically opposite air adapters. Ignition of the other combustion chambers is obtained by means of cross ignition tubes between all chambers.

Table II — I-40 Gas Turbine Average Performance Data at 11,500 rpm with Standard Inlet Conditions of 14.7 psi, 59 F, and 0 Ram.

Thrust	4000 lb
Fuel Flow	4740 lb per hr
Specific Fuel Consumption	1.185 lb per hr per lb thrust
Exhaust Temp.	1170 F
Compression Ratio	4.126 to 1
Compressor Discharge Temp.	413 F
Combustion Pressure Drop	3.18 psi
Turbine Inlet Temp.	1492 F
Air Flow	79 lb per sec

The turbine nozzle ring, containing 48 blades, directs the hot gas on to the turbine wheel. There are 54 buckets on the turbine wheel. The exhaust from the turbine wheel is diffused in an exhaust cone to a lower velocity in a circular exhaust pipe of constant diameter which carries the gas to a jet nozzle. In some installations, the exhaust pipe and exhaust nozzle have been combined into an exhaust pipe of constant taper from the exit diameter of the exhaust cone to the proper jet nozzle diameter. Table I gives some of the important dimensions and mechanical data of the I-40.

The mechanical construction of the I-40 consists of five major sub-assemblies which are bolted together to form the complete assembly. These sub-assemblies are: 1. Accessory Drive; 2. Compressor; 3. Turbine and Combustion; 4. Exhaust Cone; 5. Air Adapters.

Each of these sub-assemblies is a complete operable unit in itself so far as its particular function is concerned. Each is independently interchangeable among all I-40 gas turbines without matching, balancing, or

other special fitting. The first three have their own bearings, rotors, etc., so that they can be tested independently if desired. Advantages of this construction for production, maintenance, and field service are obvious.

The I-40 is mounted on two horizontal trunnions and a front support. The two horizontal (Turn to p. 94, please)

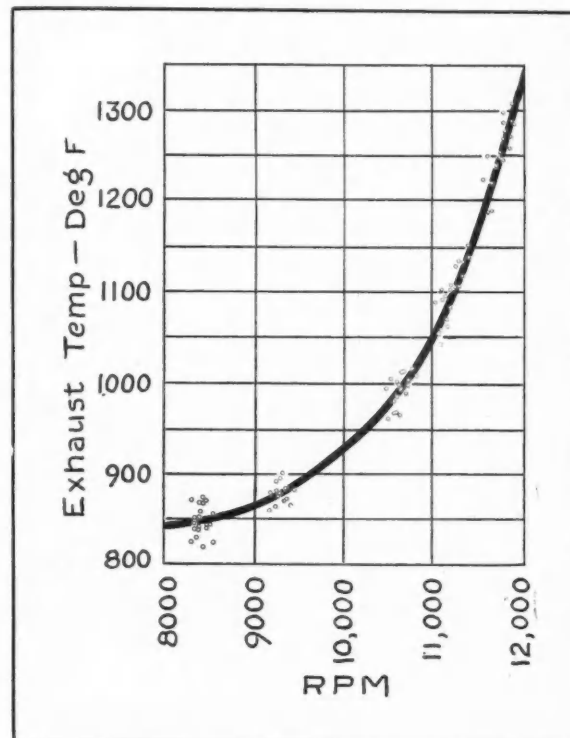


Fig. 6—I-40 Performance Data (Units 20 to 40)—Exhaust Temperature.

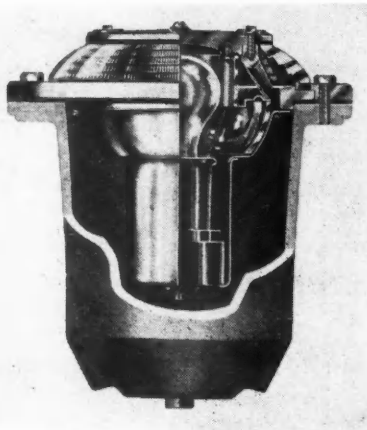
# New Products for Aircraft

## Contact Lights for Airport Runways

A contact light for airport runways, designed to carry loads imposed by new airplanes, is now in production at the Westinghouse Electric Corp.

The new light, only one ft in diameter and projecting above ground only 2½ in., is interchangeable with Army-Navy standard contact light mounting dimensions. The new unit gives better light output, meets all Army-Navy-CAA requirements and will carry a dead load of over 50 tons. This is equivalent to the load imposed by a 200,000-lb airplane taxiing over it during take-off or landing.

The frame is cantilever type, made from one of the new high strength alloy steels developed during the war. The frame carries the load, the lens floats



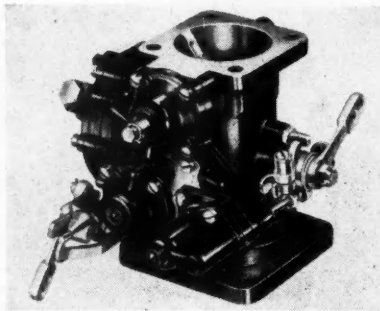
Westinghouse contact light

on synthetic rubber gaskets. The lens has very high light transmission values, and is heat treated to withstand tremendous impacts, but in case of breakage it flies into thousands of small pieces, having no sharp edges to cut tires.

## Injection Carburetion for Light Planes

The advantages of Stromberg injection carburetion are made available for the first time to the private flyer, and other users of light aircraft, in the new PS Series Stromberg carburetors for engines from 50 to 500 hp.

The Stromberg PS Series carburetors are distinctly different from previous carburetors of the same size and power range in that they use no vented float chamber or suction pick up from a discharge nozzle placed within the venturi



Bendix Stromberg PS5C carburetor

tube. Instead they have a closed and pressurized fuel feed system from fuel pump to discharge nozzle.

The venturi serves only to create pressure differentials for controlling the quantity of fuel. The nozzle discharge is under positive pump pressure. When the discharge fuel pressure drops below three psi fuel leakage past the nozzle is prevented by the closing of a spring loaded valve.

The fuel flow is automatically reduced to idling requirements when the throttle valve is moved into the idling position. Carburetor and lines are full of fuel at all times, even when the engine is stopped.

Stromberg PS carburetors are of the single barrel type. Since no float or gravity feed is used, any unit can be mounted for operation either as up-draft, downdraft or in a horizontal position. They are regularly equipped with a vacuum-operated single diaphragm accelerating pump, and a combination manual mixture control and idle cut-off; automatic mixture control and power enrichment feature, however, are optional.

## Starter-Generator for Small and Medium Size Planes

Starter and generator have been combined into a single, lightweight unit in a new starter-generator construction announced by Electrical Engineering and Manufacturing Corp., Los Angeles, Cal. Since it weighs only 19 lb, this new unit permits operators of small and medium-size aircraft the conveniences of a starter and generator without excessive loss of cruising range.

The Eemco starter-generator couples directly to the engine crankshaft. A built-in torque-limiting device protects against damage from engine backfire. Brackets are available for mounting the unit to most aircraft engines.

The generator is rated at 500 watts, for 12-, 24-, or 32-volt systems, at 50 deg. temperature rise. The gear reduc-

tion for cranking is 23:1 and for generation is 2½:1. Starter torque is ample for starting four-cylinder motors up to 125 hp; this same torque, of course, is sufficient to start six-cylinder motors of even higher horsepower.

## Lightweight Fuel Tank for Use on Planes

An airplane fuel tank made of nylon which weighs only a fraction as much as any tank heretofore devised, and which is said to have extraordinary qualities of wear and safety, has been developed by the Goodyear Tire & Rubber Co.

The nylon material weighs only .075 psf, metal tanks average .5 psf, and the bladder type rubber tank weighs .42 psf. Bullet sealing fuel tanks, used in military planes during the war, weighed approximately two psf.

Because of increased flexibility and its extreme lightness, Pliocel fuel tanks are easy to install or remove. They can be folded up for insertion through a small access door and snapped into place by glove type fasteners which attach to the supporting aircraft structure.

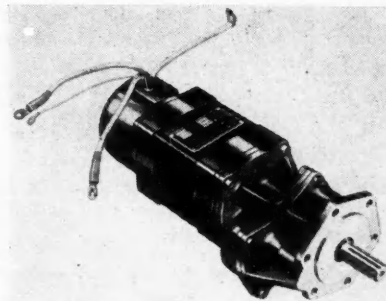
Already 18 companies are using these fuel tanks on some 30-odd models.

## Approach Angle Indicator

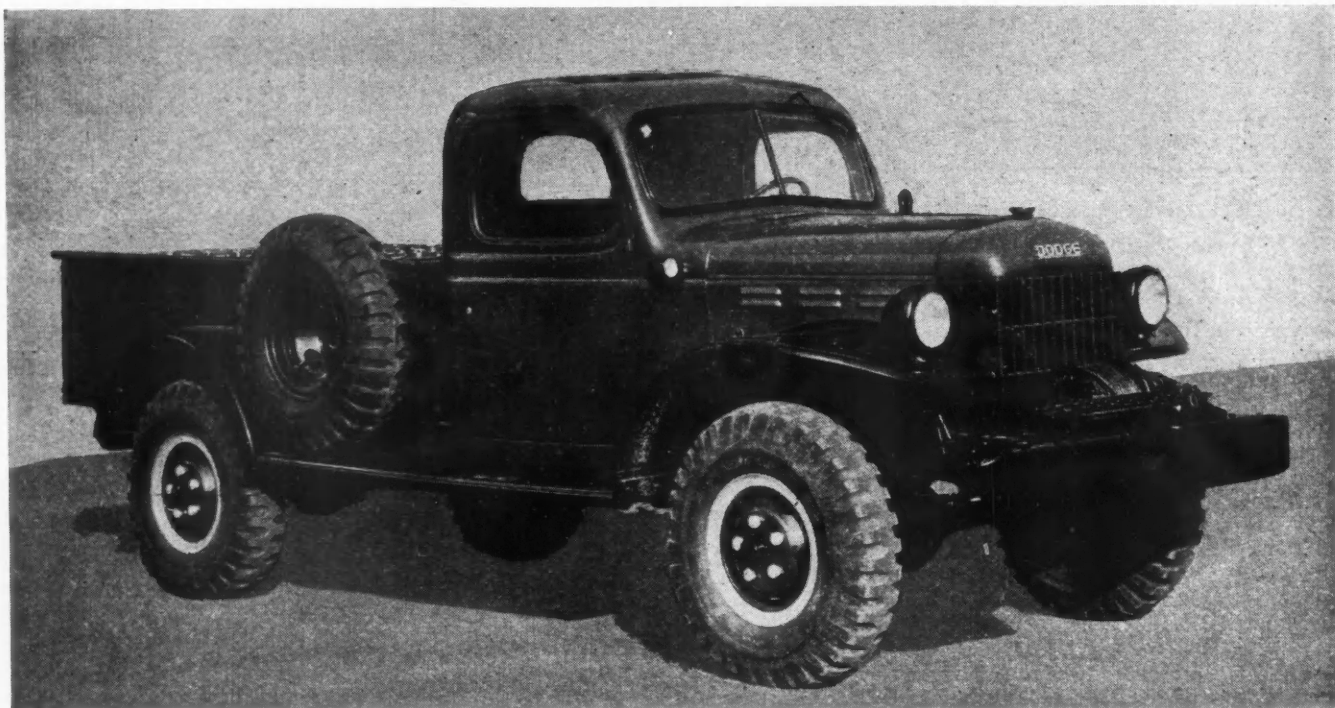
A powerful projector that "draws" a pathway of light in the sky above an airport at the correct angle of approach for a landing plane has been brought out by the Cleveland Lighting Division of the Westinghouse Electric Corp. The device, known as an approach angle indicator, can be used alone or in conjunction with radar and is said to be equally efficient in daytime or at night. The equipment has passed satisfactory tests on trial installations at military air fields.

The approach angle indicator sets the correct path for an incoming pilot by forming three wedges of light above the runway. The lower wedge is red, above it is one of green, and above that an amber one. Having located the airport and the runway, the pilot maneuvers his plane into the green pathway of light and can follow it down to a safe landing without even looking at the runway.

(Turn to page 92, please)



Eemco starter-generator



**N**EWEST addition to the Dodge job-rated truck line is a sturdy one-ton general purpose, four-wheel drive vehicle designed for off-the-highway operation and for service on unimproved roads where trucks are normally restricted in their operation. In mechanical features it is an adaptation of the Dodge military truck, 255,195 of which were built for war service by the Dodge Division, Chrysler Corp.

Availability of such added features as a two-way power take-off, the front shaft operating the winch mounted on the frame at the front, and the rear shaft for powering auxiliary equipment or a pulley for belt operations. These items provide the civilian version with versatility for application in many kinds of industrial, agricultural, public utility, and state highway uses.

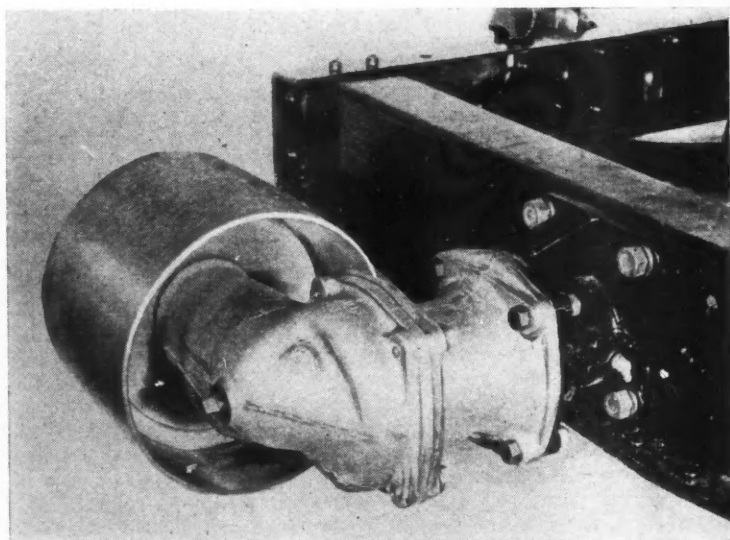
Known as the Model WDX General Purpose truck, it is mounted on a wheelbase of 126 in. and is available either as a chassis with closed cab or chassis with closed cab and steel express body. The steel body is 8 ft long, 4½ ft wide, and 22¼ in. high with large size stake pockets. The frame is of double-drop construction with side rail reinforcements. Heavy-duty hydraulic telescopic shock absorbers are supplied at the front.

With 9.00-16-8 ply tires, the gross vehicle weight with accessories is 8700 lb; the maximum payload is 3000 lb. With 7.50-16-8 ply tires, the GVW with accessories is 7600 lb; the maximum payload is 2000 lb.

The powerplant consists of a Dodge engine: L-head type, 6 cyl, 3¼ in. bore by 4⅝ in. stroke, 230.2 cu in. displacement, rated 94 bhp maximum at 3200 rpm, with compression ratio of 6.7 to 1. Maximum torque is 185 lb-ft at 1200 rpm. Interesting feature

of the engine is the use of a Carter plain tube down-draft carburetor having a nominal size of 1½ in., built with an integral velocity type governor. An oil bath air cleaner of one-quart capacity and an oil filter also are provided as standard equipment. A mechanical governor is available which provides a wide range of constant speed settings to make it adaptable for belt pulley drive and any other type of auxiliary equipment driven by the power take-off. Speed changes are made by a control conveniently located in the cab.

The power train consists of full floating hypoid type axles, front and rear, with gear ratio of 5.83 to 1; a four-speed transmission; and a two-speed trans-

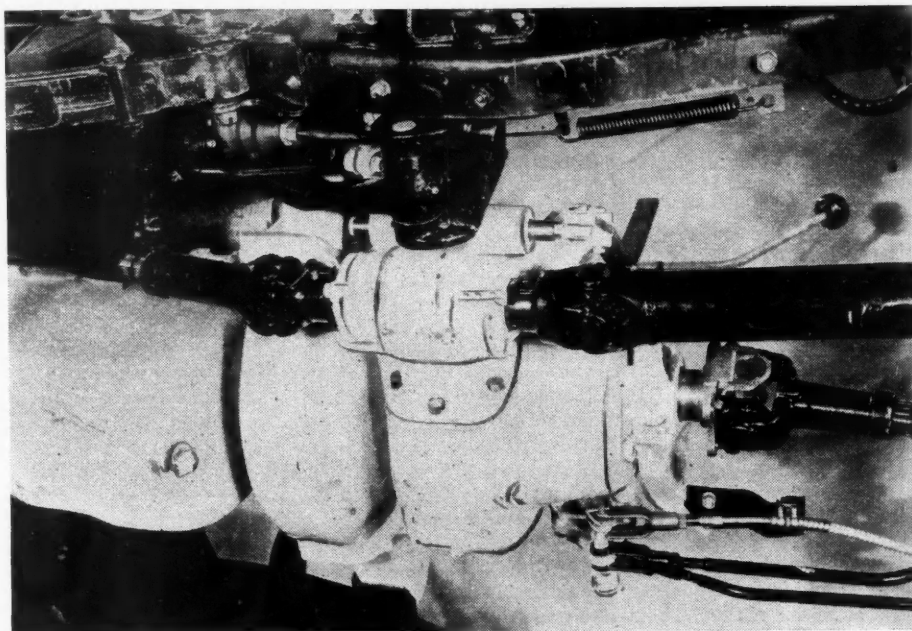


*Belt pulley unit, mounted on rear cross member, is powered by rear take-off shaft.*



*(Left) Dodge one-ton General Purpose truck, the civilian version of the military vehicle built by the division.*

*(Right) Bottom view of power take-off. The front shaft drives the winch and the rear shaft, which operates at 536 rpm, is available for driving auxiliary equipment.*



## Dodge One-Ton Truck has Four-Wheel Drive

fer case connected to the transmission by a short shaft. The transfer case has ratios of 1 to 1 and 1.96 to 1, the selection of ratio being made by an auxiliary lever in the cab. The front axle is shifted in and out of engagement by a conveniently-located lever. For operation on improved roads the vehicle is to be operated in conventional drive.

Brakes are four-wheel hydraulic,  $14\frac{1}{8}$  in. in diameter,  $1\frac{3}{4}$  in. wide, front and rear. Wheels are of ventilated disk type, 16 x 6.50 or 16 x 5.50, depending upon tire size. Steering gear is of heavy-duty type with a ratio of 23.2 to 1 for steering ease. Electrical equipment includes a 95 amp-hr battery and 35 amp generator with full voltage and current regulation.

A power take-off with front and rear drive is avail-

able for mounting on the left side of the transmission. Through the rear driveshaft it drives either stationary auxiliary equipment or equipment towed behind the truck, such as combines, corn picker, etc.

A front-mounted power winch of 7500-lb capacity is available for various purposes, with 250 ft of  $7/16$  in. steel cable. Its power is

controlled from the inside of the cab and it is driven by the front shaft of the power take-off.

A 9-in. diameter belt pulley drive is available for powering many items of auxiliary equipment, such as circular saws, silo fillers, pumps, mixers, corn huskers, separators, or threshers and feed grinders. It provides a belt speed of 3124 fpm. Mounted at the center of the frame rear cross member with four bolts, the pulley drive is easily detached and a protective cover is installed over the driveshaft when not in use.

An adjustable rear-mounted draw bar assembly is available where desired. A pintle hook is available for mounting on the frame rear cross member, where equipment that is to be towed has a towing eye arrangement.

### The Platinum Metals in 1945

Although the cessation of hostilities in mid-August was rapidly followed by a sharp abatement of demand for critical materials for military purposes, platinum is not yet in adequate supply.

Shortly after the war ended, the United States Government, and other governments, removed all remaining restrictions on the use of platinum metals for peace-time uses. This was followed by a heavy demand for platinum by domestic and foreign manufacturers of civilian goods who, having been restricted in their use of platinum

for several years, were desirous of restoring their stocks with all possible expedition and in time for the first peace-time holiday season in Dec., 1945.

Supplies of platinum in the hands of the trade were not adequate to meet this pent-up demand. United States stocks of platinum in the hands of refiners, dealers and importers when the war ended were below normal. They were approximately 20 per cent lower on Sept. 1 than at the beginning of the year. Deliveries of platinum for war purposes during the first eight months

of 1945 were well in excess of the recoveries and imports of refined metal which averaged about 25,000 troy ounces per month during that period.

Throughout the war period, domestic production of primary platinum, including Alaskan, was relatively small as compared to United States requirements. Most of our requirements came from Canada, which also supplied the major portion of palladium, rhodium and ruthenium. Columbia and Russia supplied important quantities of platinum.

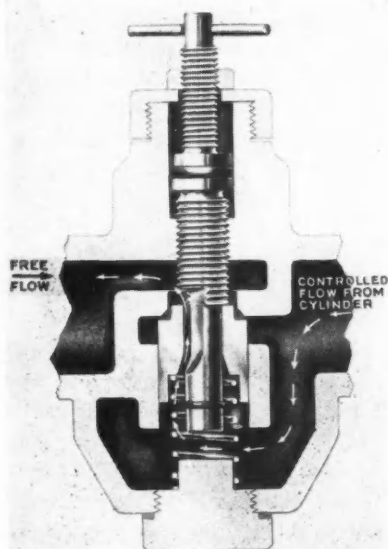
# New Products

## Speed Control Valve Has Only Two Moving Parts

To provide an unlimited range of selectivity in the volume of air, thereby giving split-second control of the piston speed, is the purpose of the Ross speed control valve, recently announced by Ross Operating Valve Co., Detroit, Mich.

The flow of air from the cylinder to the operating valve is said to be regulated with absolute precision, and in either small volume or large volume, with changes taking place with smooth progression, rather than a series of steps.

As shown by the cut-away view, there are but two moving parts—stem and poppet—with the stem so shaped as to form a venturi for the passage of

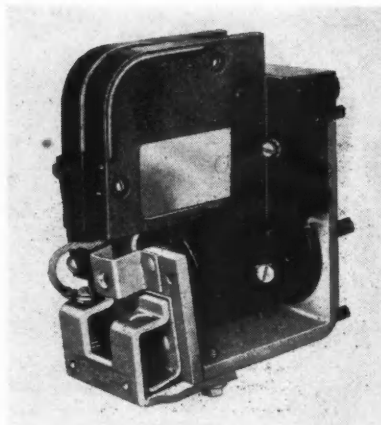


*Ross speed control valve*

air in small volume. As the threaded stem is turned downward from a closed position, incoming air in small volume is allowed to pass through the venturi into the outlet passage, increasing in volume as the stem is lowered. Continued turning of the stem causes a flange on the stem to open the poppet, permitting further increase in volume to full flow. Return air is at full flow.

## Magnetic Contactor for Machine Tool Control

For machine tool control and similar severe-duty applications where space is limited, a new type M d-c single-pole magnetic contactor has been brought out by the Westinghouse Electric Corp.



*Deep frame size Westinghouse contactor*

Small, compact design of the new contactor saves panel space, and unit construction speeds assembly and assures accurate alignment of all parts. Rear or front-connected units are available. Contactor is entirely assembled on a formed frame which also serves as a path for the magnetic flux.

The small frame contactors in this line are limited to applications in which the coil voltage and the voltage of the circuit being interrupted do not exceed 250 volts. The deep frame contactors, which provide greater winding space for the operating coil, are suitable for voltage up to 600 volts.

Operating coils are rated for continuous duty and will operate the contactors at 80 per cent to 110 per cent of their rated voltage. The contacts are insulated for a maximum potential difference of 600 volts among parts.

## Precision-Molded Synthetic Rubber Products

Plastic and Rubber Products, Inc., Dayton, Ohio, is making "O" ring hydraulic seals in a variety of sizes. The "O" ring seal consists of a round cross-section, precision-molded, synthetic rubber ring. They are installed in a rectangular groove, cut in a hydraulic piston, or in the end cap of a hydraulic cylinder. They satisfactorily seal these pistons and piston rods at high pressures, are easy to install, and permit simplified designs through elimination of multiple packing rings, stuffing boxes and gland adjusting devices.

In addition to "O" ring seals the company is producing homogeneous diaphragms, "U" cups, "V" packings, mechanical seal parts, gaskets, and many other precision-molded synthetic rubber products.

## Power Screw Driver for Small Screws

The newest addition to the Aro line of pneumatic production tools is the Midget pneumatic screw driver, Model 7000, manufactured by The Aro Equipment Corp., Bryan, Ohio.

This new tool, said to be the first power screw driver designed especially for driving small screws, is about the size and shape of the average cigar. Its capacity includes screws from No. 1 to No. 6. It weighs only 8 oz and is 4 7/8 in. long by 3/4 in. in diameter.

The Midget pneumatic screw driver is fully automatic with no manual throttle. It starts automatically when tool is applied to the work.

The rotary type motor, of four-blade construction, is equipped with ball bearings throughout, and has hardened and ground steel rotor and cylinder. Air consumption is said to be negligible.

The tool is also available with adap-



*Midget pneumatic screw driver Model 7000*

ter socket for nut setting. Finder and bits are easily interchanged for the various size screws. Tool is chrome finished.

## Micrometer and Dial Indicator Combined

A new type of micrometer, which has the additional advantage of a dial indicator, has just been introduced to the trade by Federal Products Corp., Providence, R. I.

This new micrometer is said to combine the accuracy, over the full one in. (0-1 in.) of the micrometer screw, and the precision of the dial indicator. It can also be used as a dial indicator comparator without the necessity of setting to a master; the micrometer feature furnishes its own precision setting.

As a micrometer, the spindle can be

(Turn to page 67, please)

AUTOMOTIVE and AVIATION INDUSTRIES

# Announcing

## "CLUTCH HEADS" BY NATIONAL SCREW



To serve industry still better with the most complete line of fasteners made by one manufacturer, we now offer the new and modern CLUTCH HEAD SCREWS.

More speed, added safety and longer tool life combine to reduce costs when Clutch Heads are used. Can be driven with a conventional screw driver or a special type driver. "Lock-On" feature permits easy one-handed reaching, driving and withdrawing.

In addition to the most complete line of staple fasteners made, we produce the following patented fasteners:

Phillips Recessed Screws  
Laminar Flow Screws  
Marsden Lock Nuts  
Huglock Nuts  
Dynamic Lock Nuts  
Drake Lock Nuts

Lok-Thred Studs  
Rosán Fasteners  
Scrivets  
Hi-Shear Rivets  
Lock Washer Assemblies  
Clutch Head Screws

Consult with us for information or advice on any fastener question.



*National*  
HEADED AND THREADED  
PRODUCTS

**THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.**



## Only Two Automobile Factories In Production at Year's End

*Strikes Within and Without the Industry Crippled Production More Seriously than Any Material Shortage Could Have Done*

At the beginning of 1945, the industry still was working full time on war production and the wheels were turning at top speed. During the ensuing 12 months, both Germany and Japan went down to defeat and war production ground to a rather quick stop in the automobile factories. Many car makers felt in the last days of the war that the reconversion period would be lengthened by a lack of preparation for clearing plants, reconditioning plants and machinery, and other phases of the changeover to civilian production. However, these fears proved to be groundless as the various companies moved with the vigor and directness characteristic of the industry, and three days after the official date on which car production could be resumed, the Ford Motor Co. turned out its first cars. Others soon followed, with Hudson beginning on September 1, Studebaker turning out a few cars in early September and ultimately all other companies building at least a few automobiles before the end of the year.

The task, however, was to prove more difficult than had been expected, but for an entirely different reason. The inanimate elements of production—machinery, materials and plants—were taken in stride, and by the year's end were not in themselves a problem. The chief reason why production stalled was that organized labor within and without the industry went on an orgy

of strikes that crippled production far more seriously than any contemplated materials shortage could have done.

At the year's end, only two companies, Ford and Hudson, out of 11—counting the five G.M. Divisions—which had started production in 1945, still were operating. Cadillac, Oldsmobile, Buick, Chevrolet and Pontiac Divisions of G.M. were closed by the strike against the Corporation. Studebaker, which built only a few cars, never really got going before it was forced to suspend operations in September because of the strike at Warner Gear Division of Borg Warner Corp. Willys also had to close in September for the same reason. However, that strike now has been settled and, provided that other strikes do not interfere, Studebaker and Willys should be able to resume production at an early date.

Packard suspended operations in late December because of a shortage of a transmission part furnished by Cleveland Graphite Bronze Co. which was closed by a strike October 30, and by a lack of engine bearings made by G.M. The company reports that three of the four sources are strike bound and the fourth is unable to take on any more commitments. Nash shut down its assembly lines at Kenosha following forced suspension of body building at Milwaukee because of a strike in the glass industry. Even at Ford and Hudson, both of which had to close tem-

porarily several times because of a shortage of components, production was limping along at a discouraging rate with little chance for improvement. Both companies report that the principal trouble lies in strikes in supplier plants. Chrysler Corp. had built only a few hundred cars by the end of the year, principally Dodges and Plymouths, but had not yet made any public announcement or showing. Shortage of parts contributed considerably to the late starting date.

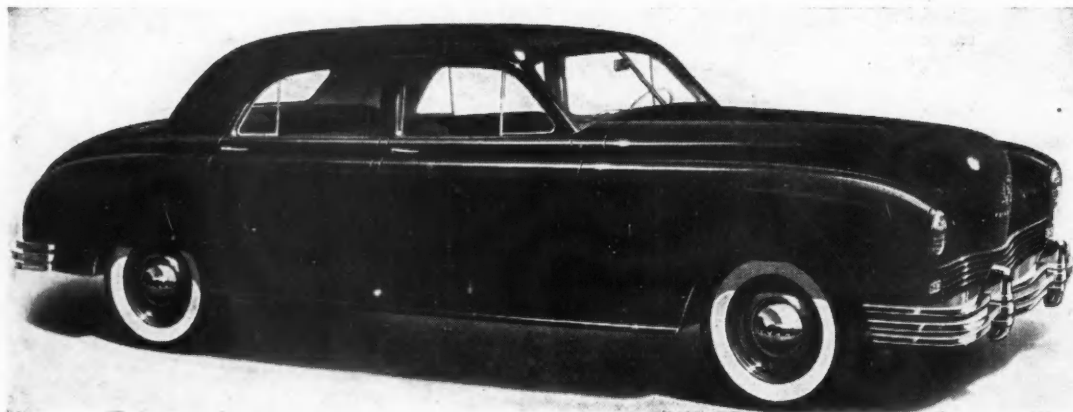
Overall production in 1945 was particularly disappointing, especially in view of the production estimates run-

(Turn to page 52, please)

## Packard Fights Against Unionization of Foremen

In a letter to all supervisory personnel, George Christopher, president of Packard Motor Car Co., has indicated that Packard will carry its fight against unionization of foremen by the Foremen's Assn. of America to the Supreme Court if necessary. He pointed out that after an NLRB election last Spring, at which foremen voted in favor of collective bargaining, the company refused to bargain in order to obtain a court hearing on the company's contention that foremen are not employees under the National Labor Relations Act, but are members of management. Packard holds further that NLRB has no jurisdiction in the matter, and that any orders issued relating to it are unconstitutional, void, and of no force or effect. The case will be heard in the U. S. Court of Appeals in Cincinnati, and should the Court rule against the company's position, an appeal will be taken to the U. S. Supreme Court.

## Advanced Body Lines Feature of New Frazer



The Frazer is a full-sized, six-passenger automobile with an overall height of 64½ in. and a wheelbase of 123½ in. It is powered by a 100-hp, six-cyl Continental engine. The body utilizes the extreme width of the car, the fenders becoming an integrated part of the body. Other features are independent front wheel suspension and forced-draft ventilation.

# THIS VERSATILITY

## *Also* Has Many POSTWAR USES

The myriad requirements of war demonstrated the amazing versatility of Vickers Hydraulic Controls. There were so many kinds of jobs to do—jobs which had to be done better than ever before—jobs which had never previously been accomplished.

For example, in this illustration, the plane has Vickers Hydraulic Control for brakes, automatic pilot and cargo door operation. The lift trucks have Vickers Hydraulic Control which lifts and positions the load accurately at the finger-touch of the operator. The graders building air fields use Vickers Hydraulic Power for steering front and rear wheels, raising, lowering or side shifting the blade, and operating the attachments.

These are just a few of the war jobs Vickers Hydraulics have done. Others include the precision movement of heavy battleship turrets—the automatic aiming of anti-aircraft guns—the fast precision positioning of ammunition hoists—the control

### **VICKERS** **HYDROMOTIVE** **EQUIPMENT**

of bomber gun turrets—and others which, cannot yet be described.

Many of the intricate machine tools that produced the machines that won the war depended for their accuracy, production speed, and ease of operation upon Vickers Hydraulic Controls.

This demonstration of the remarkable versatility of Vickers Hydraulic Controls suggests many new applications to a wide variety of postwar equipment.

**VICKERS** Incorporated • 1428 OAKMAN BLVD • DETROIT 32, MICH.

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There are more than 5000 Standardized Vickers Units that can be used in various combinations to exactly supply Every Hydraulic Power and Control Function  
**ANY FEED RATE • ANY TRAVERSE RATE • ANY R P M**  
**ANY SEQUENCE OF MOTIONS • ANY ACCELERATION**  
**OR DECELERATION • ANY THRUST . . . . .**



## Output of Nickel Declined in 1945

Deliveries of Canadian nickel to all markets in 1945 was approximately 25 per cent under the peak levels attained during the war years, but was in excess of all but one peace-time year, according to Robert C. Stanley, chairman and president, the International Nickel Company of Canada, Limited. In recent months deliveries declined substantially from the corresponding period of 1944.

Production was reduced at International Nickel's Canadian plants by a shortage of labor during the first half of the year, reaching a high of 1850 men in the spring, and by a sharp drop in nickel demand since August, caused by the sudden cutbacks in military requirements.

Up to V-E Day practically all nickel went into war uses of the United Nations. Controls on the use of nickel and nickel alloys were removed by the Canadian and United States Governments in late August, and since then consumers have again been free to purchase their full requirements.

In the six years beginning in Sept., 1939, the company produced and delivered to the United Nations about 1,500 million lb of nickel in all forms. Its capacity was materially increased in these years through expenditure of its own funds. The rate of the company's refined nickel production during the war years was about 50 per cent greater than in pre-war years.

Present enlarged nickel capacity of Canadian producers is nearly 320 million lb annually. The largest annual pre-war nickel consumption by the world was approximately 240 million lb in 1937. From this it would appear that Canada's nickel capacity is greater than the world's peace-time requirements.

## Large Attendance Predicted for National Metal Congress

Largest attendance in history is predicted for the 27th National Metal Congress and Exposition to be held in Cleveland's Public Auditorium the week of Feb. 4 through 8.

"Every indication points to an attendance in excess of 30,000 industrial visitors," stated W. H. Eisenman, managing director of the event, and national secretary of the American Society for Metals, sponsor of the Congress and Exposition. "One attendance barometer is the size of the Exposition itself. With some 350 leading manufacturers of metals, equipment, supplies and services participating, this will be the largest industrial show ever held, 25 per cent larger than the big show held in Cleveland in 1944."

"The metal industry will see many products and production techniques that have never before been available for peacetime use. Always the outstand-

ing event of the year in the metal industry, this show will have particular interest and significance because many exhibitors will introduce wartime developments and demonstrate their application to civilian production. Occupying more than eight acres of display area in the Public Auditorium and Underground Exposition Hall, more than 1500 executives and engineers will be on hand to consult with visitors to the exhibits."

Housing conditions in Cleveland during the week of the show will be crowded but hotels have given assurance of every cooperation in taking care of out-of-town visitors. To facilitate room reservations, the Cleveland Convention and Visitors' Bureau, 1604 Terminal Tower, has established a housing bureau to secure accommodations in hotels, apartments or private homes. Visitors may make advance reservations by writing the housing bureau or may apply for accommodations upon arrival at leading Cleveland hotels or at the Public Auditorium where temporary offices will be established by the bureau.

Widespread interest in the Metal Congress has also developed from plans for business and group meetings of technical societies and by the daily technical program featuring more than a hundred engineering experts in the presentation of some seventy lectures and research papers.

Thirty-one technical papers, four daily educational courses and three round table evening sessions will feature the program of the American Society for Metals during the Congress.

## Reynolds Metal Co. to Lease Aluminum Plants

The Reconstruction Finance Corp. has notified the Reynolds Metals Co. that it has approved the company's offer to lease the government-owned Hurricane Creek, Ark., alumina plant and the Jones Mill, Ark., aluminum reduction plant.

The RFC Board of Directors approved the leasing of these two plants to Reynolds Metals Co. subject to the

approval of Stuart W. Symington, Surplus Property Administrator, and the Department of Justice, and with the proviso that the royalties which will be required by the Aluminum Co. of America on certain alumina facilities be satisfactory to the RFC.

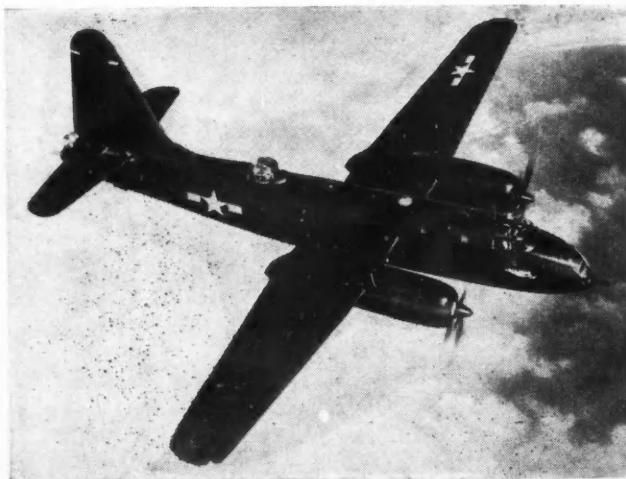
Reynolds, under the terms of its approved offer, will lease the two plants for five years on a rental basis with a minimum payment to the government during the period in excess of \$6 million, and a maximum payment for the same period of approximately \$12 million with an option to purchase at the expiration of this lease period. In addition, Reynolds will pay all real estate taxes and insurance costs, furnish the needed working capital and assume all losses, if any, from the operations. The lessee has agreed to sell alumina produced at Hurricane Creek, above its own needs, to others at cost plus six per cent. No government subsidy of any kind is involved.

Hurricane Creek is the largest alumina plant in the world with an annual capacity of 1,555 million lb. Jones Mill, twenty miles away, has a rated annual capacity of 144 million lb. of aluminum pig. However, it has a power plant capable of producing only half enough electricity required for full operation. Consequently, Reynolds plans an annual production of 72 million lb. of aluminum ingot at this plant.

## Kaiser-Frazer Corp. Buys West Coast Aircraft Plant

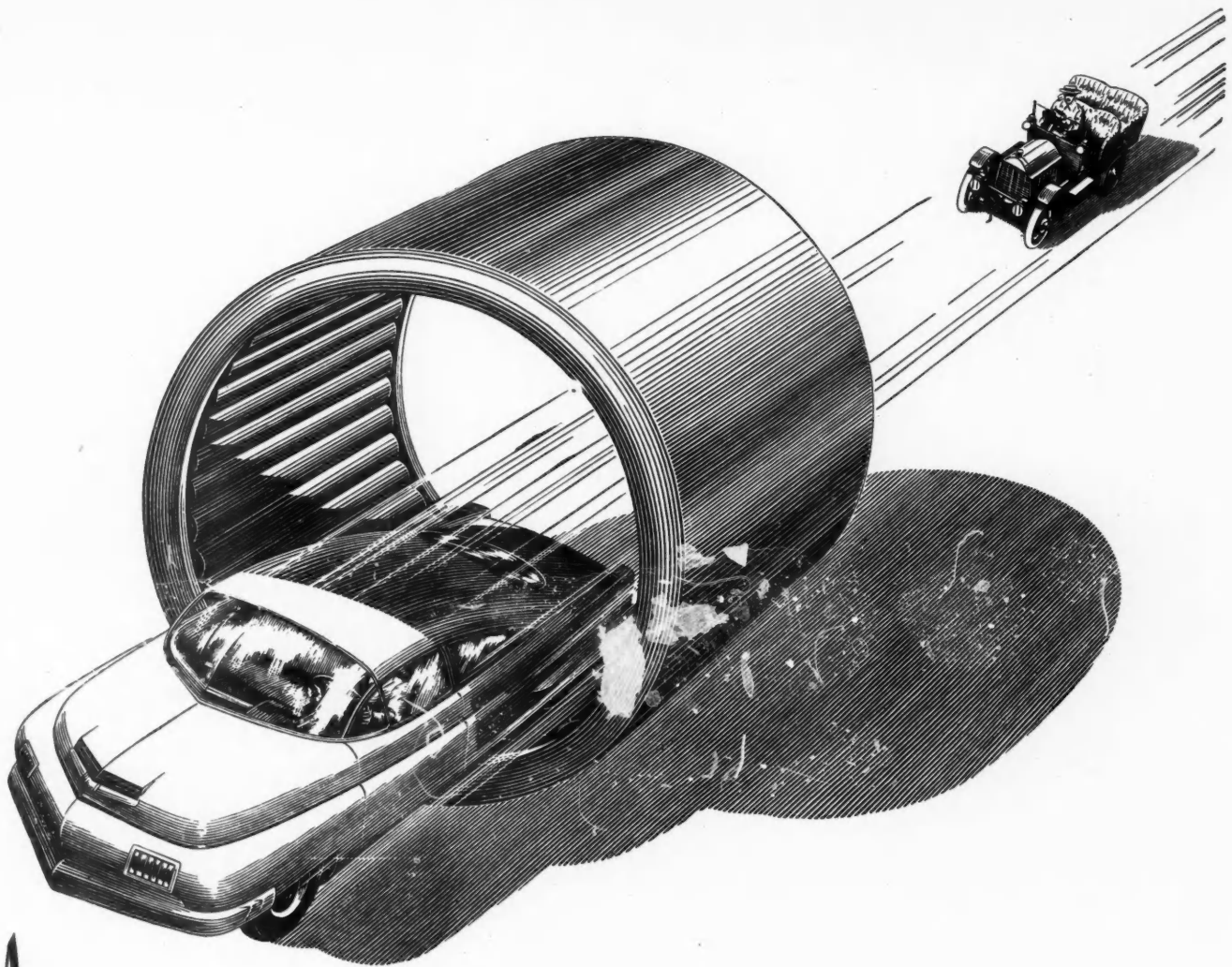
In line with its plans to expand operations to the West Coast, Kaiser-Frazer Corp. has acquired an aircraft plant in California, and conversion to automobile production will start soon. Joseph W. Frazer, president, has announced the unit will be used initially as an assembly plant supplementing production at Willow Run, but eventually will be a self-contained manufacturing unit for output of both Kaiser and Frazer cars. Employment is expected to reach 2500 persons by the end of 1946.

## Lockheed PV2



*This midwing monoplane has a wing span of 100 ft, overall length of 75½ ft, and overall height of 28 ft. Power loading is 16.1 lb per hp with maximum gross weight. Wing loading is 58 psf with maximum overload. The two R-3350-8 Wright Duplex Cyclone engines develop a total of 4600 hp. Range is 3500 miles with full load and more than 5000 miles with bomb bay tanks. (British Combine photo.)*





## A Another Engineering Advancement that is Bringing Down Costs

Engineering methods and materials have come a long way since those days in the 'twenties when the "medium priced car" sold at \$3,000. And each subsequent engineering advancement has contributed to better performance at lower cost.

That's what Torrington Needle Bearings are doing—by providing anti-friction advantages and lowering costs all along the line...

First costs are low because Needle Bearings are adaptable to precision production at low unit cost.

Assembly and housing costs are low: the bearing's unit construction facilitates handling and speeds assembly; and only

the simplest housing is required—a bore machined to proper dimensions.

And "last cost" is low: for the high capacity and efficient lubrication of Torrington Needle Bearings insure long service life. Needle Bearings never seem to wear out or require replacement.

If you are seeking improved performance at lower cost and are not fully aware of the possibilities of Needle Bearings, send for our Catalog No. 32 which gives a comprehensive picture of their many advantages.

**THE TORRINGTON COMPANY**  
TORRINGTON, CONN. • SOUTH BEND 21, IND.  
Offices in All Principal Cities

# TORRINGTON NEEDLE BEARINGS

## Romney Foresees Large Car and Truck Market

Aside from the pent-up demand developed by savings during the war years, according to George Romney, general manager, Automobile Manufacturers Association, statistics show that deterioration and other factors have multiplied the new car and truck market. Whereas 29,507,113 passenger cars and buses were registered in 1941, only 25,350,000 were registered in 1945, a drop of over 4,100,000. The public has learned much about conservation as indicated by the fact that the 1945 figure is only about 220,000 less than the figure for 1944.

Registration of motor trucks increased slightly in 1945 over 1944 but was lower than the 1941 figure. In 1945, 4,650,000 trucks were registered compared to 4,513,340 in 1944 and 4,876,054 in 1941. Of the 630,000 motor trucks manufactured this year, 315,000 went to the civilian market, the remaining 355,000 going to the armed forces. In addition 16,500 buses were produced closely approaching the 1941 figure of 16,596 and almost double the 1944 total of 9462.

Total motor user taxes have shown a considerable decline since 1941. This year taxes amounted to \$1,870,000,000, whereas in 1941 taxes were about \$2,150,000,000, another indication of wartime shrinkage of the civilian motor vehicle supply. The figure for 1945 includes \$578,000,000 in special motor truck taxes, an increase of \$25,000,000 over the figure for 1941, an indication of the heavy tax burden the truck industry is carrying.

Of 41,790 automobile dealers in business at the time of Pearl Harbor, 33,000 still were operating at the close of the war, an indication of the financial strength and resourcefulness of automotive merchandisers.

Achievement of large scale production would make possible the employment of 569,000 workers in automobile manufacturing alone, aside from parts and accessory work, by June, 1946, according to a survey released November 13 by the Civilian Production Administration. This would be only slightly below first quarter, 1945, employment on war production, and double the 1939 peace-time level.

## Foremen's League Opens National Headquarters

Management's determination to oppose vigorously, on a national scale, any attempt to separate foremen from the managerial staff was made known when President Robert F. Loetscher of the Foremen's League for Education and Association announced the opening of national headquarters at Pittsburgh, Pa.

"The objectives of the League to improve the status of the foreman as a part of management cannot be attained

if the foreman is subject to direction and control in part by others than the general management of the enterprise," said Mr. Loetscher.

He called attention to the fact that the League had withheld its initial announcement until the conclusion of President Truman's Labor Management Conference with the hope that labor would join with management in declaring that the term "employee" in the Wagner Act should be clearly defined to exclude all persons holding full-time managerial and supervisory positions. This the labor delegates refused to do.

Mr. Loetscher repeated what the 36 management delegates said in their report:

"To the foreman is delegated the ultimate responsibility of directing the workmen at the point where they are actually engaged in production. Since the foreman exercises managerial authority, he must be solely and exclusively subject to higher management.

"With union foremen having supervision of union workmen, the foreman could not receive and act on grievances for the management, since it would mean the unions had taken over both sides of the bargaining table."

Mr. Loetscher called the organizing pushes among foremen the "white hot core of the red hot labor situation," and added that "certain labor leaders are trying to steal management's shirt."

In addition to Mr. Loetscher, who is superintendent of Farley and Loetscher Mfg. Co., Dubuque, Iowa, other officers of the League are: secretary, William F. Lisman, vice-president and general manager, Leland Electric Co., Dayton; and executive secretary, William Adams Littell, Pittsburgh.

Mr. Loetscher announced that he had been successful in securing as advisers a group of business executives who will serve as the League's "Industry Reference Committee." They are: Harry Woodhead, president, Consolidated Vultee Aircraft Corp., San Diego; C. E. Wilson, president, General Motors Corp., Detroit; S. C. Allyn, president, National Cash Register Co., Dayton; F. C. Crawford, president, Thompson

Products, Inc., Cleveland; W. T. Holliday, president, Standard Oil Co. (Ohio), Cleveland; Charles R. Hook, president, American Rolling Mill Co., Middletown, Ohio; A. W. Phelps, president, Oliver Corporation, Chicago; and Louis Ruthenburg, president, Servel, Inc., Evansville, Ind.

## OPA Sets Retail Prices For 1946 Mercury Cars

Retail prices for 1946 Mercury cars have been set by OPA at approximately 4 per cent over those prevailing in 1942. The increase was allowed for changes in design and specifications. Prices at retail will be: Two-door sedan, \$1114; four-door town sedan, \$1162; sedan coupe, \$1151; club convertible, \$1320, and station wagon, \$1333. These prices do not include federal excise tax, transportation, or preparation and handling charges.

## Machine Tool Manufacturing Interests of Detrola Sold

Sale of machine tool manufacturing interests of International Detrola Corp. to Gisholt Machine Co., Madison, Wis., was announced by C. Russell Feldmann, president of International Detrola. The price was not disclosed.

The sale includes transfer of the manufacturing of Fastermatic Turret Lathes and Superfinishing machines, but excludes the equipment, lands and buildings of Detrola's Elkhart, Ind., plant, which are to be prepared at once for machining and assembly work under sub-contracts.

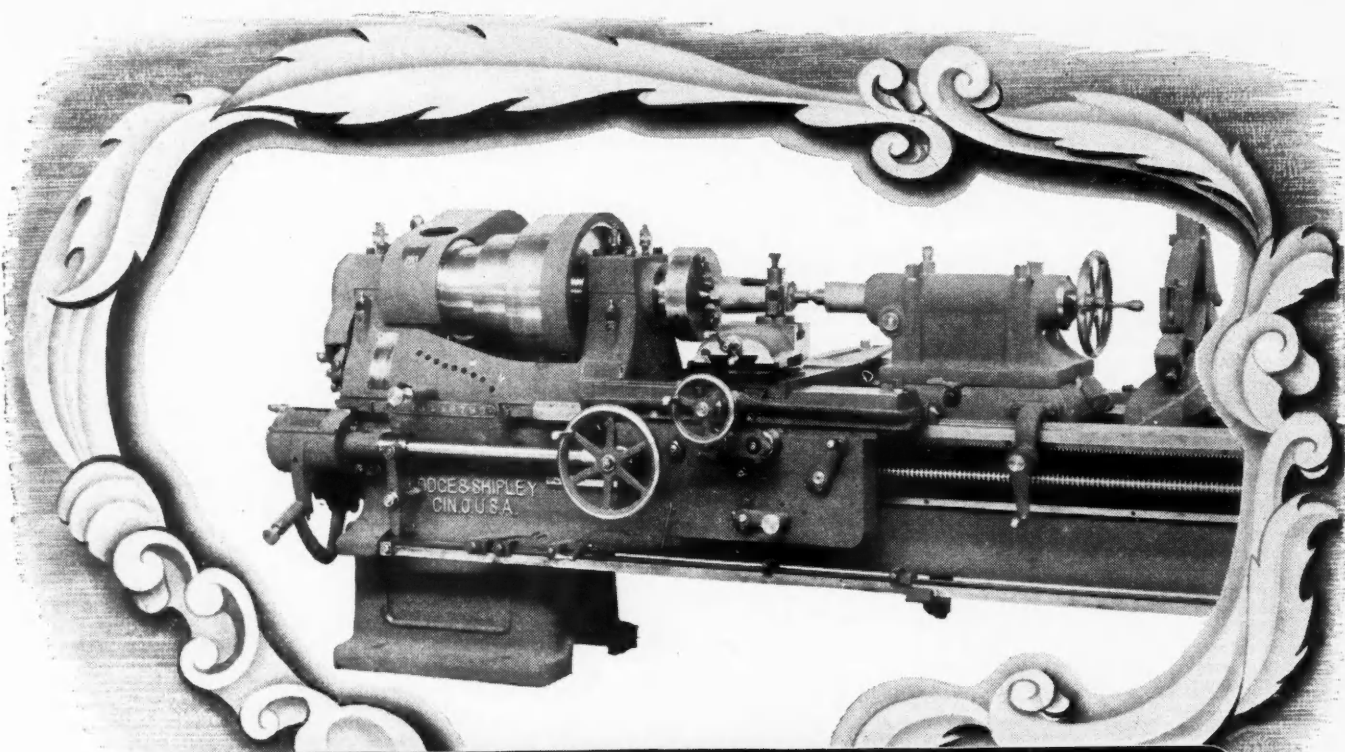
## Tin Order Amended

The Civilian Production Administration has amended its tin order to permit use of solder with a tin content up to four per cent in the repair and manufacture of passenger cars. It provides, however, that this solder must be obtained through secondary recovery (tin scrap.) Previously, no tin had been permitted in solder for passenger cars.

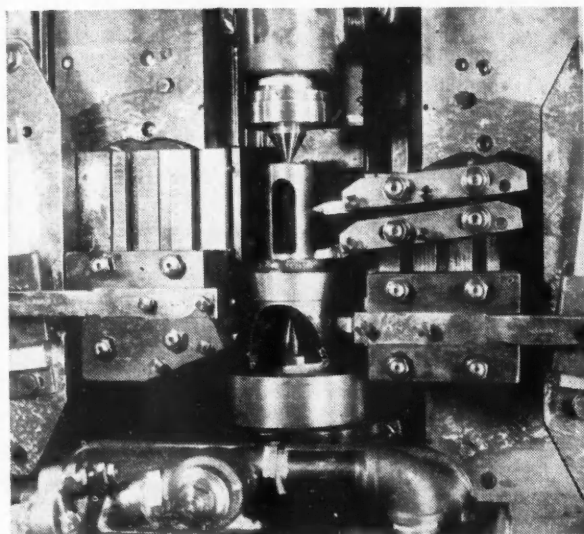
## France Builds Sub-Stratosphere Plane



*Built for sub-stratosphere travel, the Bellatrix transport plane is a sleek, streamlined 12-ton sky liner. First of its type to be built in France, this twin-engine transport has a top speed of 300 mph, and a cruising speed of 257 mph. It can make non-stop flights of 1250 miles. A feature is the insulated cabin, constructed to withstand temperature extremes. Designed after the fall of France by the French engineer Parot, the Bellatrix was camouflaged and hidden at Draguignan until after the liberation.*



## HOW WELL CAN A 1917 LATHE *Do Today's Valve Jobs?*



L & S Engineers will gladly give you a practical demonstration of Duomatic superiority on your own work. There is no obligation. Write for detailed literature No. 601 and No. 620 on 2A and 3A Duomatics.

●Imagine the old-fashioned lathe above being used on a tough chrome nickel alloy steel valve. Limited to a few feeds and a single tool, separate settings were required for straight and taper turning. In those days it took a skilled operator considerable time to turn a valve job.

Obviously, this lathe would be completely inadequate for a shop requiring high output, precision work, and low costs. Yet lathes even a few years old may be almost as obsolete—when placed alongside the new 2A or 3A Duomatic, Lodge and Shipley *full automatic* lathes.

Consider the valve plug at the left done on a 3A Duomatic. Multiple tools perform all straight turning operations at one time, front and rear, and taper turning front and rear—simultaneously. The set-up for two tapers is easily converted to set-ups for tapers of different sizes. An unskilled operator can turn out precision valve parts quickly and economically.

Dual tool slides—front and rear—operate singly or together . . . can be used for a wide range of cycles in turning and in straight and angular facing operations. A Duomatic is like two lathes in one. It may actually equal several of your old or pre-war models in total output, plus quality and accuracy never before obtainable.

# LODGE & SHIPLEY

**MACHINE TOOL CO.**

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**L & S**  
**LATHES**



## PUBLICATIONS

Cuno Engineering Corp. has published a bulletin on its new Coolant-Klean filter, designed to remove abrasive and metallic particles from grinder coolant. It is a compact, replaceable-element type filter, applicable to unit machines or centralized system.\*

Complete information about its new Wheelabrator Swing Table is contained in Catalog No. 214, published by American Foundry Equipment Co. Detailed information on each of the four sizes including construction features, overall dimension drawings and specifications is contained in the 12-page catalog. Sections are also devoted to ventilation requirements, operating performance facts and installation photographs.\*

A new 12-page booklet on rubber and synthetic products created to suggest application of these products to industrial designers has been published by The B. F. Goodrich Co. Several pages are devoted to the physical and chemical properties of Koroseal, a synthetic flexible material. Vibro-Insulators, devices of rubber and metal designed to reduce vibrations of machinery and the buildings in which they are situated are also described.\*

A new folder on its gasoline hose and fittings has been published by The B. F. Goodrich Co. The folder describes and pictures the operating advantages of its tank truck hose with oil and gasoline proof synthetic rubber tube and cover, as well as all the fittings needed for its use.\*

A Data Sheet, Safety Tools of Ampco Metal, issued by Ampco Metal, Inc., discusses a new line of safety tools made of monel metal. The bulletin contains chemical composition and properties of the monel tools, suggested applications and similar data.\*

Worthington Pump and Machinery Corp. has issued a new bulletin on its vertical turbine pumps. Drawings of the various pumps, together with installation information are included and a few of the many services to which Worthington Vertical Turbine Pumps may be applied are given.\*

W. F. and John Barnes has issued an attractive new booklet on special machine tools for diesel engine metal working operations. It pictures many types of machines designed by Barnes, operations performed by these machines, gives specifications and tooling and operation data for each machine pictured.\*

Booklet 1045, Inserted Blade Cutters, describes milling cutters of many required types and sizes manufactured by Midwest Tool & Mfg. Co. Included are illustrations of special application cutters, and cutter sharpening suggestions.\*

An up-to-date price list and catalog of Airco arc welding accessories has been published by Air Reduction. The 12-page booklet illustrates and describes a complete line of accessories for all types of arc welding machines and operations. A section is devoted to Airco Heliwelding equipment for welding magnesium.\*

A new 4-page catalog released by the Monarch Governor Co. describes a new model governor that is centrifugally controlled, includes installation instructions and parts list and prices.\*

A new, illustrated catalog has been issued by The H. O. Canfield Co. Detailed illustrations cover the wide use and varied application of rubber parts to the automotive, aviation, electrical and general industrial fields. Molded, die-cut, and extruded parts as well as stock and specialty items are included.\*

The current issue of Twin Disc Clutch Co.'s publication, Production Road, features hydraulic drives. Questions regarding selection of the best type of hydraulic drive for a particular type of application are answered under the heading of Converter or Coupling?, a non-technical article of impor-

tance to manufacturers and users of all types of powered industrial equipment and machinery. The construction, operation and application of both types of hydraulic drives are fully and plainly discussed. Photographs and field data gives the advantages of each type of drive in various fields of application.\*

\* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

## Jack & Heintz to Build Engine of Die Castings

William S. Jack, president of Jack & Heintz, Inc., Cleveland, has told his employees (associates) that the company will be producing an engine built principally of die castings within the next few weeks. He stated that the engine will turn up one horsepower for every cubic inch of piston displacement. Previous reports have indicated that the company is working with the Skinner slide valve engine of horizontally-opposed design. Jack did not indicate what company would use the engine. The Kaiser-Frazer Corp. had been reported to be considering it, but has since announced that Continental Motors engines would be used.

## CALENDAR

### Conventions and Meetings

SAE Annual Meeting and Engineering Display, Detroit	Jan. 7-11
Plastics Exhibit, Detroit	Jan. 7-11
National Aircraft Show, Cleveland	Jan. 11-20
American Institute of Elec. Engineers, New York	Jan. 21-25
American Society for Metals, Cleveland-Natl. Metal Show	Feb. 1-8
American Society for Testing Materials, Pittsburgh Spring Meeting	Feb. 25-Mar. 1
Pan-American Aircraft Exposition, Dallas	Mar. 1-5
American Management Association, Atlantic City, N. J., Packaging Exposition	Apr. 2-5
Amer. Soc. of Mechanical Engineers—Spring Meeting, Chattanooga	Apr. 1-3
SAE Natl. Aeronautic Meeting, New York, N. Y.	Apr. 3-5
Midwest Power Conference, Chicago	Apr. 3-5
American Society of Tool Engineers, Cleveland Tool Engineers Exposition	Apr. 8-12
Natl. Assoc. of Corrosion Engineers, Kansas City, Mo., Annual Meeting and Convention	May 7-9
Associated Business Papers, Hot Springs, Va., Spring Meeting	May 22-25
Amer. Soc. of Mechanical Eng.—Detroit	June 17-20
American Society for Testing Materials, Buffalo Annual Meeting	June 24-28

## Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

An upward trend of general business activity has been continued. The New York Times index for the week ended December 8 stands at 129.8, as compared with 128.0 for the preceding week and 145.4 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended December 8 were 10 per cent. greater than those in the corresponding period last year. The total for the year to date is 11 per cent. above 1944.

Electric power production during the week ended December 15 was increased to the highest level since August. The output was 9.0 per cent below that a year ago, as against a comparable decline of 9.7 per cent. in the preceding week.

Railway freight loadings during the week ended December 8 totaled 776,375 cars, 3.4 per cent. below the figure for the preceding week and 2.1 per cent. below that for the corresponding period last year.

Crude oil production in the week ended December 15 averaged 4,514,700 barrels daily, 45,800 barrels more than the preceding rate but approximately 4 per cent. less than the corresponding quantity last year.

Bituminous coal and lignite production during the week ended December 8 totaled 12,045,000 net tons, 2.5 per cent. below the preceding weekly output. Total production thus far this year is 8.2 per cent. less than the comparable amount in 1944.

Civil engineering construction contracts awarded during the week ended December 20, according to Engineering News-Record, totaled \$63,768,000, about 6 per cent. below the figure for the preceding week but 215 per cent. greater than the corresponding amount last year. The aggregate value of contracts recorded for 51 weeks of 1945 is 33 per cent. more than the comparable sum in 1944.

The wholesale price index of the Bureau of Labor Statistics for the week ended December 8 turned downward, to stand at 106.5 per cent. of the 1926 average, as against 106.8 a week earlier and 104.2 a year ago.

Member bank reserves declined \$573,000,000 during the week ended December 12. Underlying changes reflected include an increase of \$35,000,000 in Reserve Bank credit and a rise of \$619,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an increase of \$91,000,000 in money in circulation.

Total loans and investments of reporting member banks increased \$894,000,000 during the same week. A rise of \$164,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$7,128,000,000, shows a net increase of \$708,000,000 in twelve months.

## New Goodrich Plant

The B. F. Goodrich Company will construct a new plant for the processing of plastics near Marietta, Ohio. The plant, to be located on a 66 acre tract of land on the west bank of the Muskingum River, will consist of a main building having a floor area of 112,000 sq ft with auxiliary and service buildings adding 48,000 additional sq ft.

## The CONE AUTOMATIC MACHINE COMPANY



sees many

# GOOD THINGS AHEAD

### It is reported that . . . . .

A technical magazine states that the war-developed arc-oxygen electrode will cut quarter-inch steel plate at the rate of a foot per second while under 40 feet of water. *Metal and Thermit Corp.*

get ready with CONE for tomorrow

It is estimated that within a few years 80% of the coal mined underground will be removed from the mines on conveyor belts instead of in cars. *Scientific American.*

get ready with CONE for tomorrow

The PV-3 helicopter has a long fuselage with a rotor on each end and carries twelve persons. It is being tested by the Coast Guard and Navy. *Popular Science.*

get ready with CONE for tomorrow

A new cement, for use in concrete flooring, is said to drive away insects, kill bacteria, and prevent the formation of molds. It also dissipates static electricity. *H. H. Robertson Co., Pittsburgh.*

get ready with CONE for tomorrow

An appliance manufacturer announces an electric washing machine that can also, by the use of attachments, wash dishes, peel potatoes, churn butter, and freeze ice cream. *Hurley Machine Division Elec. Household Utilities.*

get ready with CONE for tomorrow

A new gasoline-powered lawn mower resembles a floor scrubbing machine. It is mounted on four wheels and uses a rotary knife revolving at 3,000 r.p.m. *Whirlwind Lawn Mower Corp., Milwaukee.*

get ready with CONE for tomorrow

The manufacturer of the jet engine used in the P-80 Shooting Star prophesies that all transcontinental planes will be jet-propelled within five years. *General Electric.*

One of the war devices that may survive to help the motorist is the tire gauge that registers on the dash, developed for the Army's amphibious "duck." *GMC Truck and Coach Div.*

get ready with CONE for tomorrow

A magnetic survey of the state of Florida shows large areas in the southern part that are favorable for the occurrence of petroleum. *U. S. Dept. of Mines.*

get ready with CONE for tomorrow

Meals are being served in the Naval Air Transport Service that are pre-cooked, packed in a covered paper plate and frozen. On the plane they are thawed and heated in a special oven. *Maxon Sky Plate, W. L. Maxon Corp., 460 W. 34th St., New York.*

Air conditioned trolley cars are being introduced in a Southern city. This is said to be the first use of such equipment in city vehicle transportation. *Atlanta, Ga.-Pullman-Standard.*

get ready with CONE for tomorrow

A new household electric light switch can be set for delayed action up to three minutes. *T. J. Mudon Co., 1240 Merchandise Mart, Chicago.*

get ready with CONE for tomorrow

Rubber V-belts molded around a steel cable have been developed to replace chain drive on Army motorcycles. *Goodyear, Akron 16, Ohio, Whizzer Motor Co., Los Angeles.*

get ready with CONE for tomorrow

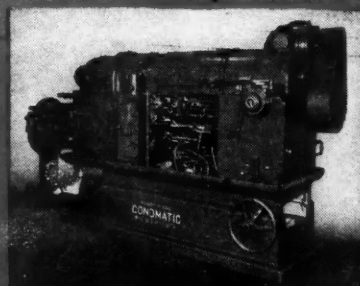
Even the common wire nail has been improved. The new type has a notch in place of the point and is claimed to be non-splitting. *E. S. Gair, Snyder, New York, inventor.*

## 15 operations in 12 seconds



The 15 operations that form this washing-machine part of B-1112 steel, including rolling the oil groove\* in the outside diameter, are performed by the 8-Spindle Conomatic in 12 seconds.

\*Write to Cone for particulars



# CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

24



## PERSONALS

### Recent Appointments Among Automotive and Aviation Manufacturers:

Ford Motor Company, Paul B. Hoffman, Executive Staff, General Sales Div.

General Motors Corp., Chevrolet Motor Div., W. E. Fish, Asst. Gen. Sales Mgr., in charge of eastern half of the United States; G. I. Smith, Asst. Gen. Sales Mgr., in charge of western half of the United States.

General Motors Corp., Fisher Body Div., William S. McLean, General Director, newly created public relations and advertising division; James P. Wines, Asst. General Director; Carl W. Moyer, General Director, Industrial Relations.

Nash Kelvinator Corp., Nash Motors Div., Shelton R. Houx, Asst. Director of Adv.

Pontiac Motor Div., Norman G. Helwig, Business Management Manager.

Continental Motors Corp., N. W. Hopkins, Director of Public Relations.

Kaiser-Frazer Corp., Frederick W. Watson, Mgr. of the Body Div.; Norman C. Schassberger, Chief Body Engineer; Harold E. Keck, Mgr. of Sales Statistics for both Kaiser-Frazer and Graham-Paige Motors.

Packard Motor Car Co., W. D. Foster, Northern Michigan District Mgr.

Willys-Overland Motors, George F. Bluth, Asst. Works Mgr.

Willys Export Corp., Marcel F. DeMuller, Sales Mgr.

Luscombe Airplane Corp., Donald S. Grubbs, Treas.

The Studebaker Export Corp., Charles R. Weaver, Asst. to the President, R. A. Hutchinson.

Douglas Aircraft Co., John D. Weaver, resigned to enter private business.

United States Rubber Co., election of five new vice presidents, as follows: Ernest G. Brown, Gen. Mgr., Mechanical Goods; John P. Coe, Gen. Mgr., Naugatuck Chemical and Synthetic Rubber Divs.; H. Gordon Smith, Gen. Mgr., Textile Div.; John W. McGovern, Gen. Mgr., Tire Div.; Elmer H. White, Gen. Mgr., Footwear and Fuel Cell Divs.

United States Rubber Export Co., L. C. Boos, elected President; Herbert G. Kleswetter, elected Vice-President.

Baldwin Locomotive Works, B. A. Springer, Sales Engineer; Robert G. Allen, General Sales Mgr.

Spicer Mfg. Corp., L. B. Simonds, Sales Engineering Staff.

Ramsey Accessories Mfg. Corp., Harry Liss, Mgr., newly created Export Dept.

Gar Wood Industries, Inc., George D. Shaeffer, Vice-Pres. in charge of Engineering.

The International Nickel Co., Inc., Dr. John G. Dean, appointed to Development and Research Div.

Allis-Chalmers Mfg. Co., Ralph A. Powers, Engineer in charge of electronic engineering.

Sylvania Electric Products, Inc., E. Finley Carter, Vice-Pres. in charge of engineering, replacing Roger M. Wise, resigned. Shuler Axle Co., Frank O'Callaghan, elected President.

Philco Corp., David B. Smith, Vice-Pres. in charge of engineering.

Republic Steel Corp., Union Drawn Steel Div., H. E. McPherson, Asst. Mgr. of Sales. Wilkening Mfg. Co., Don Greene, Asst. Mgr. of Replacement Sales Div.

Norma-Hoffman Bearings Corp., Harold J. Ritter, elected President and a member of Board of Directors.

Allegheny Ludlum Steel Corp., Max J. Pischke, Mgr. of Warehouse Sales.

Bendix Aviation Corp., Radio Div., John D. Scalbom, Sales Engineer, Bendix Airline-type of radio equipment for executive planes.

The Lithium Co., Stuart K. Oliver, Gen. Sales Mgr. and Research Director.

International Plastic Corp., Richard W.

Gerwin, Retail Sales Mgr., Cellulosic Dept. National Magnesium Corp., George W. Lonergan, Treasurer.

The American Welding & Manufacturing Co., H. D. Malone, Asst. Sales Mgr.

Ethyl Corp., Baton Rouge Plant, William Irwin, Asst. Resident Mgr.

Westinghouse Electric Co., Industrial Electronics and X-Ray Divs. (Baltimore), E. R. Nary, Asst. to Walter Evans, Vice-Pres.

American Brake Shoe Co., Brake Shoe and Castings Div., Horace A. Deane, Works Mgr. Manganese Steel Div., Joseph B. Terbell, Executive Vice-Pres.

Product Designers, Walter F. Nessen, Chief Industrial Designer.

The Aro Equipment Corp., M. J. Anderson, Sales and Service Engineer.

Rheem Research Products, Inc., Charles C. Martin, Vice-Pres.

### Abrasive Company Changes Name and Trade Mark

A new name—Simonds Abrasive Co.—will identify the Abrasive Co. of Philadelphia, effective Jan. 1, 1946. The Abrasive Co. became a member of the Simonds organization in 1927, when it was purchased by Simonds Saw and Steel Co. of Fitchburg, Mass.

Simultaneous with the change in name, a new Simonds master trademark will be officially adopted. This new trademark will identify all products of Simonds Abrasive Co. as well as those manufactured by all branches of the Simonds Saw and Steel Co.

There is no change in ownership, management or policy.

### White Motor Co. Acquires Plant in Cleveland

White Motor Co. has acquired from the government the Nottingham Equipment Works, operated by General Electric Co. at Cleveland. The plant will be expanded to 360,000 sq ft, double its present area, and all bus production will be concentrated there. Cost of the project is estimated at \$2.5 million. White now has a backlog of orders to-

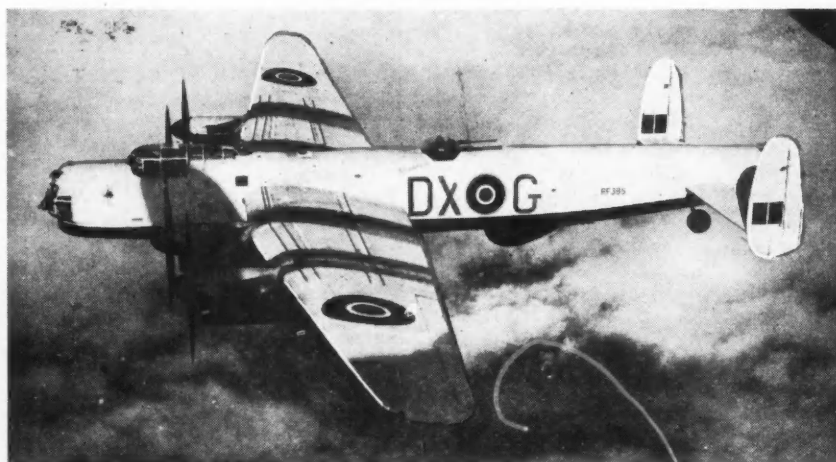
taling about \$14 million for urgently needed city transit buses. Concentration of bus production in the new unit will free space for building trucks to meet what Robert F. Black, president of the company, calls a "critical truck shortage."

### Only Two Factories In Production

(Continued from page 44)

ning up to 500,000 cars which had been made soon after V-J day. The combined total for all companies, while not available in exact totals, probably will not exceed 80,000. Ford built approximately 35,000, General Motors about 23,000, Chrysler probably somewhere in the neighborhood of 3000 and the various other companies around 18,000. The prospects for any sizeable gains in production during the first part of 1946 are not propitious. Labor trouble is expected to continue for several months in one form or another. The General Motors strike could conceivably run for two or three months, and Ford still has not reached a point in negotiations with the union that could be considered safe from strikes. Suppliers have little optimism over the situation, since they have been plagued by strikes continually since V-J Day, and the outlook is bleak for any relief until the major car manufacturers come to an agreement with the union. Then it will be a question of whether the smaller independents and the parts companies can follow the pattern set on wages by the Big Three. Even when the automobile industry gets its labor relations in order, there still are wage questions to be settled in other industries which are closely related—principally steel and glass. If any of these is strike-bound, car production will be limited or entirely stopped.

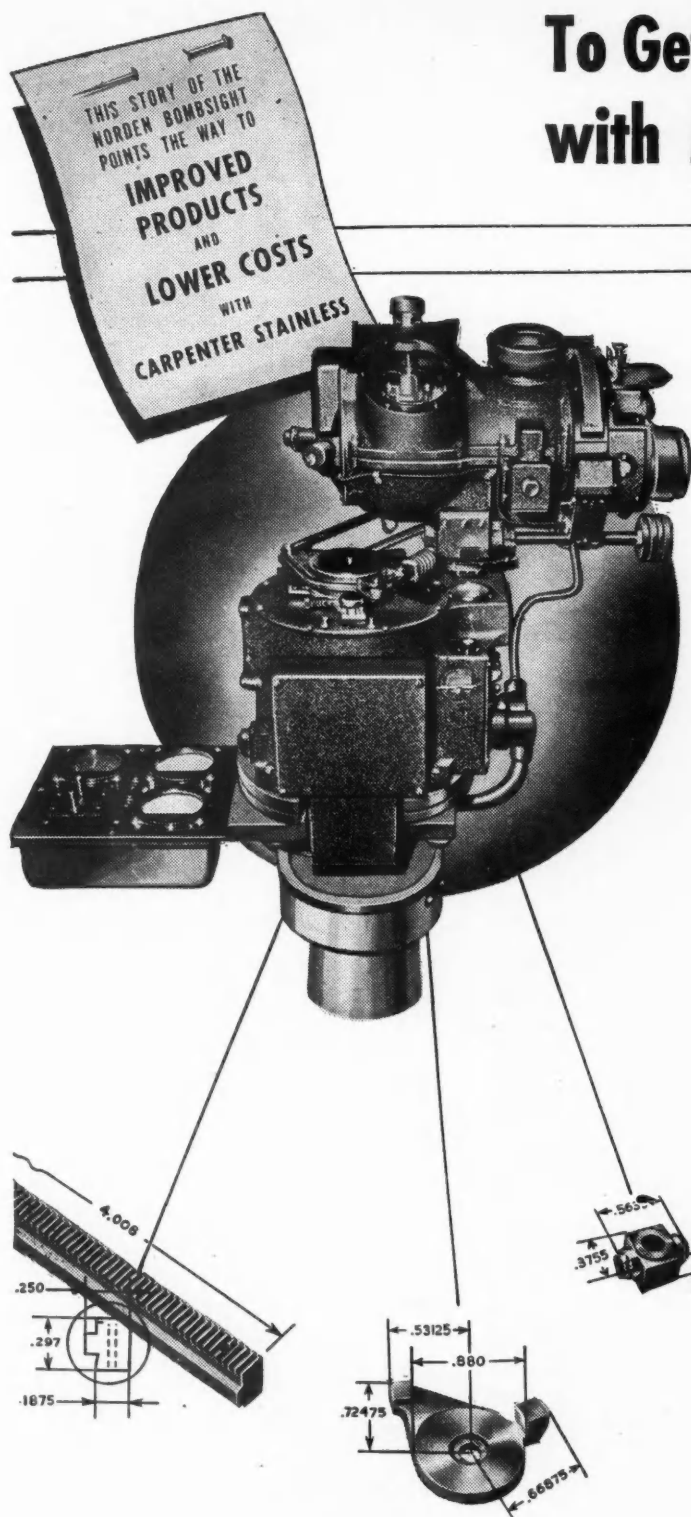
### British Lincoln



This plane is said to be the biggest and best bomber now in operation with the Royal Air Force. Features are: Radar-sighted .50-cal machine guns in the rear turret, remote controlled .50-cal machine guns in the front turret operated by the bomb aimer, and 20-mm British Hispano cannon.



# To Get High Precision Parts with Fewer Rejects . . . . .



... use the Stainless that met exacting Norden bombsight requirements

● If ever a job called for close tolerances, plus product dependability, it was this famous bombsight.

The requirements were tough. For instance, one small piece—the heart and nerve center of the bombsight—was held to a tolerance of  $\pm .0001$ ". The part contained less than 1¢ worth of steel, yet was listed as an \$8 cost item. Stainless was a "must" for this and many other vital parts, because corrosion resistance, wear resistance and a high strength/weight ratio were necessary.

Why Carpenter Free-Machining Stainless was first choice for these bombsight parts is a story that can now be told.

You can sum it up in one word—"dependability". Said one of the factory superintendents: "Experience with material obtained from other sources has convinced me that we have *less rejections, better machining time, less trouble in straightening, and better tool life* with Carpenter Stainless No. 5 bar stock."

Your own precision requirements may be less severe, but you will benefit by the consistent, money-saving uniformity of Carpenter Free-Machining Stainless. Made to tool steel standards in a tool steel mill, Carpenter Stainless guarantees top-flight performance.

Try Carpenter Free-Machining Stainless Steels and see what a difference they make in your production set-up. Your nearby Carpenter representative will gladly help you in solving your Stainless problems. Call him or write us at the mill.

The Carpenter Steel Company • 103 W. Bern St. • Reading, Pa.

## Carpenter STAINLESS STEELS



### BRANCHES AT

Chicago, Cincinnati, Cleveland, Detroit, Hartford, Indianapolis,  
New York, Philadelphia, Providence, St. Louis

## BOOKS ...

**WHY HAS AMERICA NO RIGID AIRSHIPS?** by P. W. Litchfield and Hugh Allen, published by Corday & Gross Co., Cleveland, Ohio. Price \$1.50.

There is still a definite place in America's air program for the big lighter-than-air Zeppelins. Striking improvements in airplanes which have come out of the war have not eliminated the airship from the picture, particularly in the field of long distance travel over water, the authors contend. The airship can operate at half to a third the cost of the airplane. The absence of air sickness and sea sickness,

plus roominess, offers greater passenger comfort than either the airplane or the steamship. Therefore, because of the inherent advantages of the airship, America should use all three methods of travel for trans-oceanic service.

The disasters airships have encountered are analyzed, with the conclusion that they were no different than the setbacks encountered by all new machines. The book points to the 181 successful ocean crossings of the German Graf Zeppelin and Hindenburg as proof that airships are practical, states that the loss of the latter ship was due to hydrogen fire, and could not have happened to an American ship filled with helium.

The book reviews the research work that has gone into airships; the performance of Navy blimps during the war and their ability to operate in fog conditions when

other aircraft were grounded; the accumulation of operating experience by Navy and civilian pilots; and gives figures on the projected 10,000,000 cubic foot passenger airship. Government aid would be needed at the outset because of the size of the operation, it is stated, but once under way, an airship line would need no more help from government than that given other carriers in foreign commerce.

**THE AUTOMOTIVE CHASSIS** by P. M. Heldt, First edition, published by P. M. Heldt, Nyack, N. Y., 584 pages, price \$6.00.

"The Automotive Chassis" is the final volume of Mr. Heldt's series of Automotive Engineering books. Like the other volumes, it is intended both as a handbook or reference book for engineers, and as a textbook for use in engineering courses. It is a practical treatise for those concerned with the design, production and maintenance of motor vehicles.

All parts of the automotive chassis are covered, with the exception of the powerplant. The functions of the parts, their theory, their design and the materials from which they are made are all discussed in detail. To supplement the text, there are 380 clear and well selected illustrations. Most of the chapters contain brief notes on the origin and the historical development of the parts with which they deal, as well as an explanation of shortcomings of earlier designs and the reasons for abandonment.

Design formulas or equations expressing the operating characteristics of the parts are developed from basic principles. Rules for the proportioning of parts are given in almost every chapter, and these, together with numerous illustrations of stock parts, should prove helpful and stimulating to the designer.

## Du Pont Consolidates Two Divisions

Consolidation of two divisions of the Organic Chemicals Department into a single unit under the name of the Petroleum Chemicals Division was announced by E. I. du Pont de Nemours and Co.

The merger combined the former Alcohol and Tetraethyl Lead Divisions, operating plants at Deepwater, N. J., and Baton Rouge, La.

J. L. Stecher, who was manager of the Tetraethyl Lead Division, was appointed division manager, while William F. Krug, Jr., formerly manager of the Alcohol Division, was named assistant manager of the new unit.

## Lodge & Shipley Appoints Dealer for New England

The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, announces the appointment of the Rudel Machinery Co., Inc., Boston, Mass., as exclusive dealer in the New England territory comprising Maine, Vermont, New Hampshire, Massachusetts and Rhode Island.

The Rudel Machinery Co. will handle the entire line of engine, tool room, manufacturing and Duomatic (automatic) lathes produced by Lodge & Shipley.

**THE FIRST OF THREE CLEANING ACTIONS OF A VORTEX OIL BATH AIR CLEANER**

Dust-laden air entering through the central inlet tube strikes the oil above the disc, where it is deflected sharply upward into the prefilter.

The heavier particles of dust are thrown against the oil surface.

This action drives the oil which is above the disc outward toward the walls, and part of it passes into the settling chamber through the slots in the rim of the disc, carrying with it the entrained dust.

The dust settles to the bottom of the cup and the clean oil continues the circuit through the central orifice of the disc to repeat the action.

*Write for Bulletin F-1295 and F-1297*

**VORTEX**  
AIR CLEANERS

**VORTEX COMPANY, CLAREMONT, CALIFORNIA**



## EXIDE POWER AND RUGGEDNESS MEET ALL DIESEL CRANKING NEEDS

In all parts of the world, in all climates, and in the toughest on and off-the-highway service, Exides are daily proving that their extra power and sturdy build measure up fully to all Diesel cranking demands.

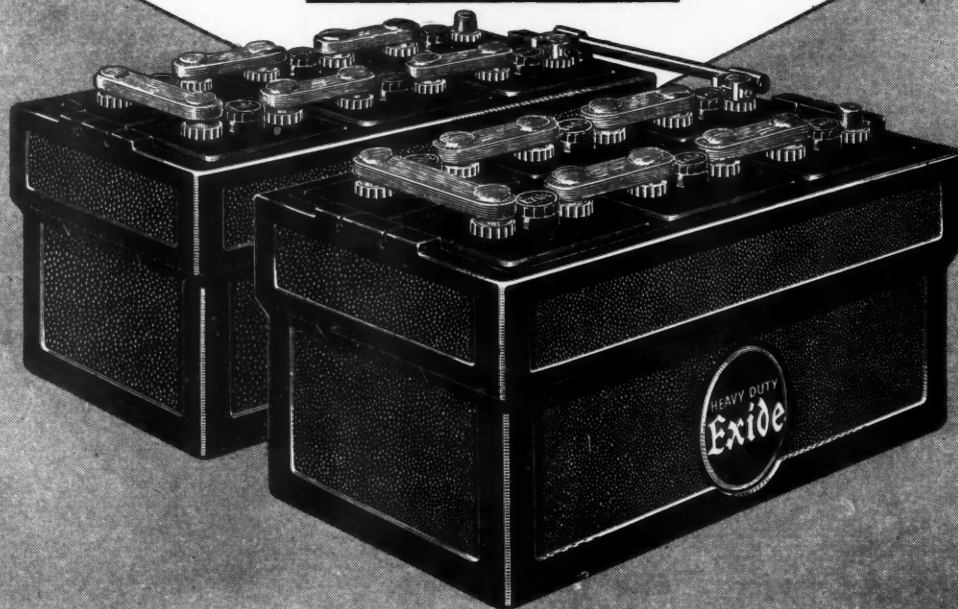
Their rugged construction keeps them steadily on the job under the most severe working conditions. For dependability, long-life and ease of maintenance, you can always count on Exide—the battery designed specifically for Diesel engine cranking.

Write today for a FREE copy of the Exide Catalog of Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

**Exide**  
HEAVY DUTY  
BATTERIES





# Air Turbine Refrigeration Cycle

(Continued from page 34)

the fire extinguishing agent.

3. Use of an automatic flight control which would correlate and integrate manifold pressure, propeller rpm, mixture and throttle setting in one control for each engine to give proper performance.

4. Developing a control means which would automatically feather an engine in the event improper rpm, manifold pressure, or temperature occur.

5. The development of an instru-

ment which would correlate true indicated airspeed with fuel flow consumption, resulting in a final reading which would give the pilot continuous information in terms of miles per gallon.

## Control Decks

In his paper, "Control Decks For Long Range Aircraft," Capt. H. J. Chase, Pan American Airways, Inc., strongly urged that aircraft engineers and pilots get together and work out the many problems of instrumentation

and control decks with some view towards standardization so far as this is possible with craft for different operations. Instrument panels ultimately become short of space and the development of standardization of cockpit instrumentation at the present time is chaotic.

His paper also brought to light facts, many of which probably will be given an attentive ear by designers. In the location of crew stations, the speaker said the following basic principles should be observed:

1. The relative distance between pilot and co-pilot.

2. Relation of pilot and co-pilot to the instrument panels and the other necessary controls which they must operate.

3. Flight engineer's station should be close to and behind the co-pilot with the engineer's panel readily visible from the captain's station.

4. The jump seat station should be behind the captain, but capable of swinging to a central position between the pilots.

5. Radio operator's station should be behind the flight engineer's station and should preferably face forward.

6. The flight navigator's station should be on the left side and behind the jump seat with navigator facing forward, navigator's chair to be adjustable, forward, backward and vertically. Navigator's table should be flat and capable of being adjusted to slant.

A practical approach to vibration problems may be the addition of shock mounting to all crew personnel stations, including their chairs, instruments, accessories and tables, and to the controls as isolated units. The next step would be to shock mount or isolate the control deck and its component parts from the rest of the aircraft. The final step should be to eliminate vibration at the source, making shock mountings unnecessary.

Considerable study must be given to lighting which affects safety and fatigue. Fatigue is affected through eye strain and through the nervous irritation that the pilot sometimes undergoes with spot lights, rim lights, flood lighting, red lights and argon lights, to mention but a few. Control deck lighting requires all instruments to be readable, glare be eliminated, and illumination intensity be variable.

Much remains to be done on standardization of cockpit instrumentation. The one point on which all agree, said Capt. Chase, is the location of flight instruments. They are placed directly in front of the pilots so as to require the least movement of the eyes. Consolidation of these instruments into one very large unit has been attempted in only a few cases and this problem

(Turn to page 58, please)



## "AVAILABLE" Tuthill Equipped

ALWAYS "available" for tough hauling jobs—compact, rugged, serviceable—with more load space per pound of weight—this efficient truck was built by the AVAILABLE Truck Co. Fitted with TUTHILL Quality Leaf Springs, it can be relied upon for dependability and low-cost haulage. Made of inspected, tested, heat-treated alloy steel, Tuthill springs are tougher, easier-riding, longer-lasting.

**TUTHILL Leaf Springs are made in standard and special types. Write us your requirements. Let Tuthill Engineers help you.**

**TUTHILL SPRING COMPANY 763 W. POLK STREET CHICAGO 7, ILL.**



**Quality Leaf Springs for Sixty Years**

GET THE  
*Inside*  
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FROM THESE  
**FACT-JAMMED  
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Report No. 1  
**ASSEMBLY SAVINGS  
WITH PHILLIPS SCREWS**

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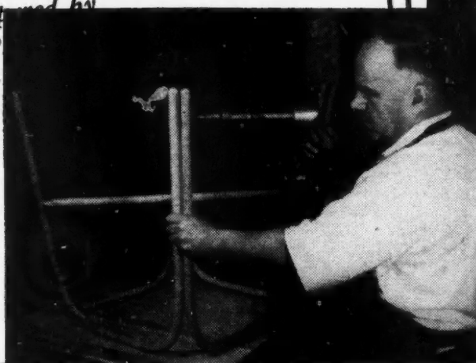
HEYWOOD-WAKEFIELD  
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Furniture - R.R. Car and Bus Seats  
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INDUSTRIAL  
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**AN INDEPENDENT SURVEY!  
AUTHENTIC! UNBIASED!**

*This investigator from the James O. Peck Co., industrial research authorities, is visiting leading American plants to get unbiased facts on assembly savings. His reports are available to you.*

**HEYWOOD-WAKEFIELD**, like countless other successful manufacturers, use Phillips Screws for one good reason . . . *to cut costs.* When they discarded slotted screws and specified "nothing but Phillips" (with production savings up to 50%) they pointed up a lesson you can't afford to ignore with today's squeeze on profits!

The report on Heywood-Wakefield - and others now completed - are so revealing we are not wait-

ing to publish them in a completed volume as originally planned. They will be distributed NOW - flash news of *current* economies you can make - **AS THEY COME OFF THE PRESS!**

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**FIND OUT HOW  
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**SAVES UP TO**

in assembling furniture,  
car and bus seats, baby  
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**50%**

By avoiding driver skids, parts spoilage, and delay required to demount and replace them . . . by driving screws faster at awkward angles that meant burred and broken screw heads with slotted screws . . . by eliminating pilot holes . . . by using fewer and smaller screws without sacrifice of holding power . . . by using power in place of hand drivers.

**SALES BENEFITS**, too, in lastingly rigid, burr-free fastenings that won't snag clothing . . . in the ornamental Phillips Recess that improves appearance, permits simplified design.

**GET THE COMPLETE STORY** and see why, more and more, Phillips Screws spot the profit-planned product!



**PHILLIPS Recessed Head SCREWS**

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.  
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PHILLIPS SCREW MFRS.,

c/o Horton-Noyes

2300 Industrial Trust Bldg., Providence, R. I.

Please send me the reports on Assembly Savings with Phillips Screws.

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Company.....

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should be brought to its logical conclusion. Few instruments in the United States are of the vertical type of indication and in certain instruments this would be desirable. Study should be given to the type of dials and the graduation of the dials to facilitate their readability to crew members.

Noise level is one of the problems on which engineers have worked quite successfully. This problem must be continuously studied to reduce the noise level until it will be possible to carry on a normal conversation clearly and concisely with crew members without the use of interphone.

### Aircraft Interiors

In his paper, "Aircraft Interiors From the Airline Viewpoint," R. W. Rummel, Supt. of Engineering Planning, Transcontinental and Western Air, Inc., said that the aircraft interior can be properly conceived only if the job or function it is to fulfill when the aircraft is placed in service is considered to be the prime design criterion. The quantity and type of payload, the range, the speed, the operating cost and resulting fare structure, and the overall utility of the vehicle determine the interior concept. This concept is of fundamental importance.

It dictates the remainder of the aircraft design.

While all of these and many more details must be considered before the design can be finally resolved, the starting point is the determination of the type service to be rendered. With this known, the designer can evolve the proper fuselage size and arrangement giving the best utility for the function to be performed.

For example, the first thing that must be known to design or determine the most attractive all-cargo airplane is the average load and density of that load, the size package to be carried, the distance it is to be carried and the permissible fare for transporting the package that distance. Knowing this, the designer can lay out the required fuselage size and shape, keeping in mind such important items as loading and unloading characteristics, the required aerodynamic characteristics and the power requirements to best meet the performance cost specifications.

Similarly, the development of the passenger or combination passenger-cargo airplane must be based upon a clear definition of the intended use of the airplane. The designer is confronted with the choice of designing all out to one specific objective (and, perhaps for one customer) or compromising the design somewhat to permit greater flexibility of use. This is also a difficult problem for the operator since, while it is his desire to obtain the most efficient instrument to do a given job, it is also his desire to keep the number of types of airplanes in his fleet to a minimum to reduce maintenance and overhaul costs and to minimize personnel training.

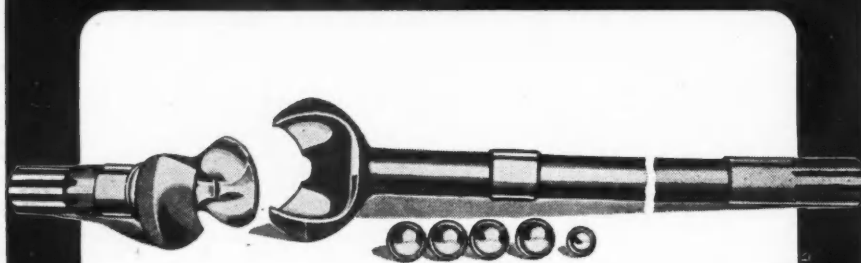
"Psychological Requirements of Aircraft Passenger Cabin Design" was the title of a talk presented by Dr. Howard K. Edwards, medical director of Eastern Air Lines, Inc. Aircraft interiors should be standardized so far as possible in order that the public becomes used to planes more readily.

Interiors should be done in colors to conform with the seasons—warm colors in cold weather and cool colors in warm weather. The use of correctly chosen colors is both restful and reassuring to passengers. Strong emotional colors like red and orange should be avoided so far as possible, since in the case of many individuals, such colors tend to increase nervousness. Quieter colors, soft greens, yellows, blues and purples tend to relax passengers. Green seems to be ideal for cabin interiors for it can be warmed by the addition of yellow for cold weather flying and cooled by the addition of blue for warm weather flying. It is a job for the interior decorator and, above all, the colors should not be chosen by individual taste.

Dr. Edwards also stated that a feeling of roominess and structural strength could be obtained by shaping contours to imply these qualities. Plenty of fresh air and a cabin tem-

(Turn to page 60, please)

In the Bendix-Weiss Rolling Ball Universal Joint



Here Shown Disassembled

**STROM BALLS**  
*Serve the Armed Forces*

Here, in the Bendix-Weiss Constant Velocity Universal Joint, Strom Balls do their part in making military vehicles, from Jeeps to 14-ton Armored Cars, the efficient fighting equipment that they are. This is only one spot in our great war production effort where the high degree of perfection of Strom Balls serves industry, enabling it to provide the finest bearing equipment towards its great contribution to total victory. Strom Steel Ball Company, 1850 South 54th Avenue, Cicero 50, Ill.

**Largest Independent and Exclusive Metal Ball Manufacturer**

**Strom** BALLS  **Serve Industry**



# LEADERSHIP

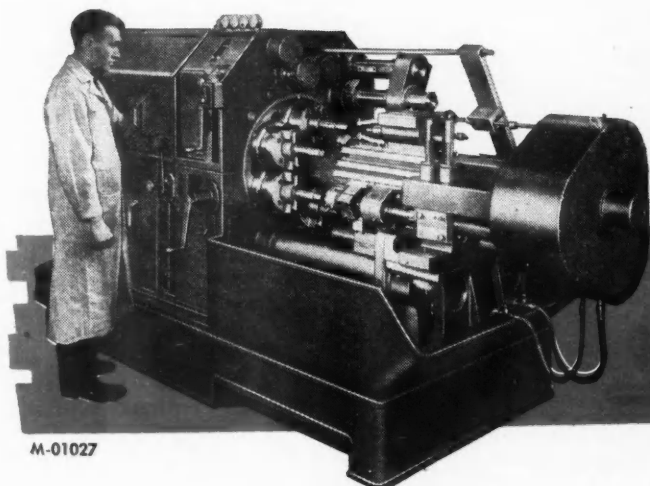
## PROVED BY HUNDREDS OF CASE HISTORIES



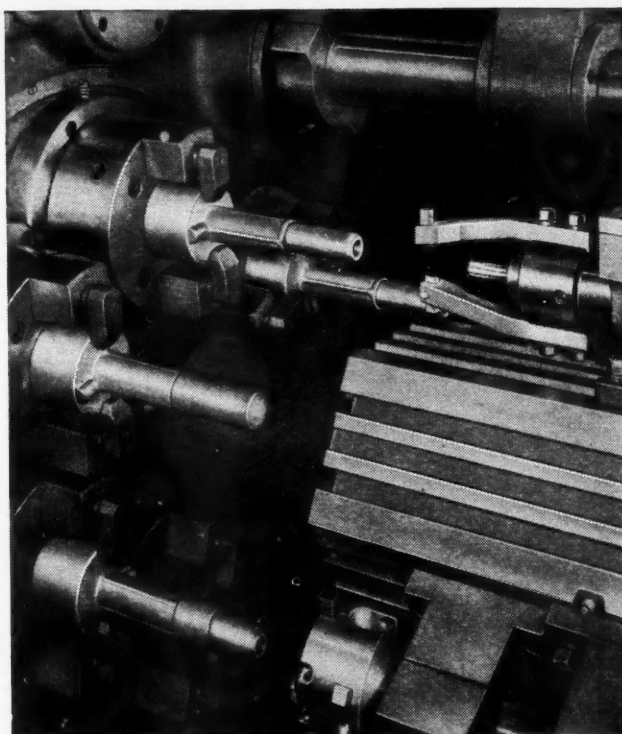
Cast Iron Distributor Base, now machined on New Britains by one of America's leading automotive manufacturers.

In order to speed production the manufacturer sought a method of doing this job on a multiple spindle chucking machine. The difficulty presented was the necessity for maintaining the required concentricity of the hole ( $\pm .005$ ) between the bowl and shank ends. Because of the thin wall at the bowl end and the long 9-3/16" shank the drilling operation was made extremely difficult by the weave in the shank as it was turned. New Britain engineers developed the answer, with the use of special hydraulically operated hook bolt fixtures and drill guide on a New Britain Model 675 chucking machine.

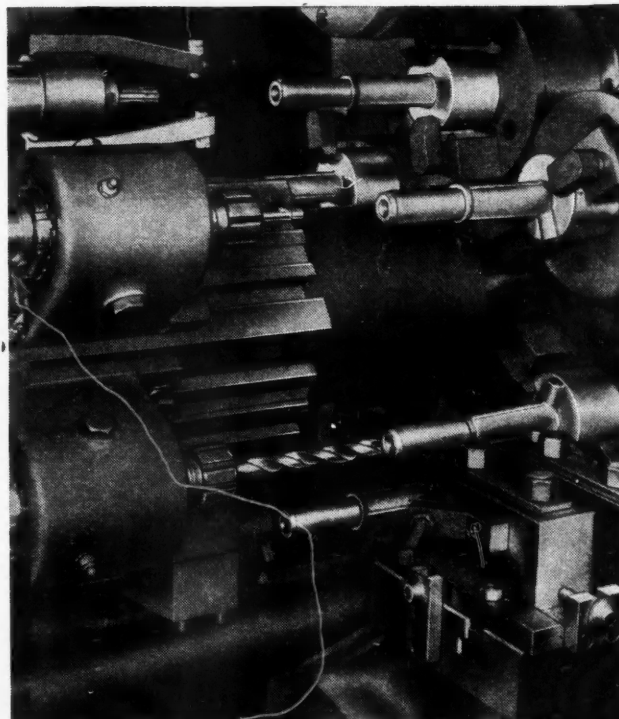
Production was stepped up six times over that of the lathes formerly used. The operation is performed in 19.4 seconds, or 186 pieces per hour, and with concentricity well within the manufacturer's requirements. Here is another typical example of how the versatility of New Britain Automatics and New Britain engineering has applied the economy of multiple spindle automatic production to a job which formerly limited the manufacturer to slower, more costly methods.



M-01027



ENTIRELY OPEN END CONSTRUCTION...  
LOADING POSITION EASILY ACCESSIBLE



REAR VIEW: NOTE ACCESSIBILITY OF ALL TOOLS

THE NEW BRITAIN MACHINE COMPANY  
NEW BRITAIN, CONNECTICUT  
NEW BRITAIN-GRIDLEY MACHINE DIVISION

# SAVE SUPERVISION in fitting PRECISION PARTS



**YOU PROBABLY KNOW** Laminum shims as assembly time savers. But have you overlooked the fact that in fitting machine parts by peeling these precision laminations, considerably less supervision is required. You have the certainty of uniform accuracy ... with no spoilage. Your request for data invited.

*Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.*

Laminated Shim Company, Incorporated  
51 Union Street  
Glenbrook, Conn.

## LAMINUM

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

2221

perature of 69 to 70 F is ideal. So far as possible, sound and resultant vibration should be eliminated at the source. Too high a noise level brings on quick fatigue to passengers and crew alike. The designers should bring down the decibel level to that of a present day living room.

The speaker stressed the advisability of placing in plain sight such items as fire extinguishers, oxygen masks, first aid kits and similar things which would have a much more reassuring effect upon passengers. The safety belt might also be of a contrasting color to that of the seat material to emphasize the belt.

### Fluorescent Lighting

Continuing along the lines of airplane interior passenger comfort, F. A. Rugge, of Transport Engineering Div. Curtiss-Wright Corp., presented a paper, "Fluorescent Lighting for Commercial Airline Interiors."

Fluorescent indirect lighting is a necessary luxury that should be considered for the cabins of new airline airplanes. The illuminated cabin interior of these planes should enable the passenger to see easily and to relax. Studies made at Nela Park Laboratories of the General Electric Co. indicate that whether we view a brightly lighted golf course or an artificially lighted room or theater stage, the same basic relationship of illumination brightness applies for eye comfort. Mr. Ward Harrison, Director of the Nela Park Engineering Division, has expressed this relationship in the following ratio: "For eye comfort keep the range of brightness, particularly of adjacent areas in the visual field, within reasonable limits—10 to 1—if possible."

Basic facts expanded according to present needs formulate today's cabin lighting objectives. These are:

1. Adequate illumination of all objects in the field of view (recommended minimum of 5 ft candles).
2. Soft white light that accentuates the color and freshness of objects and fabrics.
3. Eye comfort. As the main illumination source generally predominates the field of vision, the light source should be concealed in an indirect fixture or a direct fixture of low surface brightness. The adjacent reflecting surfaces should be of low surface brightness not greater than 10 to 1, if possible, compared to reflection of other objects in the general field of view.
4. Night lighting is best accomplished by aisle lights and not by reducing the level of the general source of illumination.
5. Illumination for passenger reading should be provided by special reading lights in combination with the general illumination. If the ratio of light from surrounding areas is of too great contrast (greater than 10 to 1) the eyes tire from the continual shifting and refocusing between the dark and light areas. Minimum  
(Turn to page 64, please)

# *"Dreadnaught"* ELECTRICAL CONNECTION COUPLING-CABLE KIT for **ALL** Tractor-Trailer Combinations

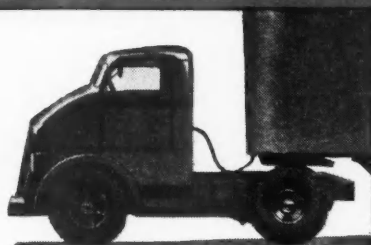
Rugged, Permanent, Weather-Proof Installation Assures Trouble-Free Service for Running Lights, Stop Signals, Turn Signals, Parking Lights — All Electrical Contacts FOR LIFE OF THE VEHICLES.



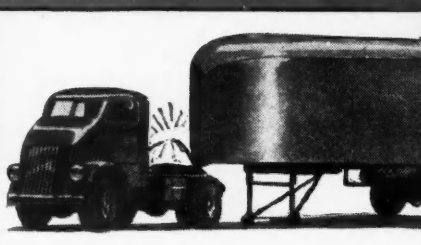
**THIS COMPLETE KIT  
EASILY INSTALLED!**

The WARNER "Dreadnaught" Kit includes 2 ruggedly constructed, weather-proof Coupling Sockets. (1 each for cab and trailer). Heavy-Duty Coupling-Cable with wires and rugged connector units for all electrical requirements molded in extra heavy, flexible rubber "hose," as easy to plug in or out as a radio — Cable Supporting Spring and Clamp — complete with Mounting Bolts, Nuts and Washers for quick, easy installation.

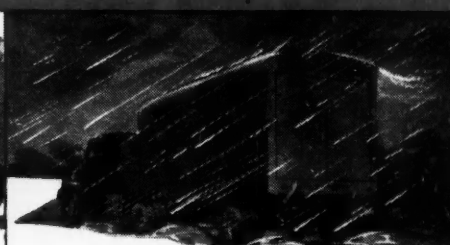
## SOLVES THESE PROBLEMS



Flimsy, ordinary connections fray or break under severe road and weather conditions.

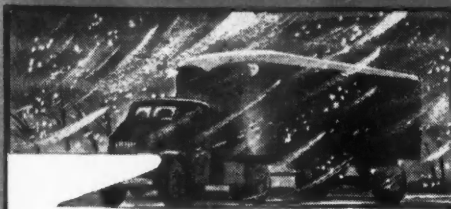


No snapping off by a "pull-away".

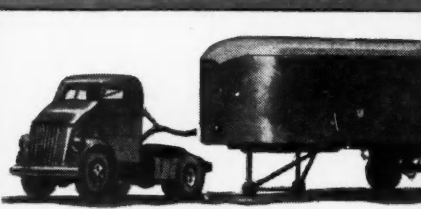


Trailer "blackouts" bring fines, delays, and accidents!

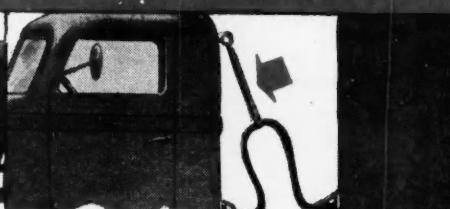
## PROVIDES THESE ADVANTAGES



— Ruggedly constructed, weather-proof WARNER "Dreadnaughts" stand up under severest road and weather conditions.



If driver fails to disconnect on drive-away, rugged cable pulls connector out of trailer socket — cover springs shut to prevent corrosion.



Heavy Cable Support Spring prevents cable from dropping in mud, water or sand.

A Product of WARNER ELECTRIC BRAKE MFG. CO., Beloit, Wisconsin



(Continued from page 60)

illumination for passenger reading should be 15 ft candles.

A survey was conducted by Curtiss-Wright (Report 20-V14) on the relationship of illumination levels produced from strip lighting fixtures as installed in the CW-20 airplane using fluorescent F-15 lamps. The range in illumination values on objects comprising the central field of vision varied from four to 40 ft candles. The exceptions were the values of illumination from the lower surface of the fixture (2 ft-c) and the illumination of the top and the lap-level of the outboard chairs (2 and 3 ft-c, respectively). Although these imperfections should be corrected to be

within the range of 10 to 1 for best eye comfort, they have not been considered too detrimental to the overall lighting scheme. The lower fixture surface was painted a dark blue gray and that has since been changed to a light cream color, thereby reducing the contrast to allowable limits. The illumination of the tops of the outboard chairs is in low contrast with the adjacent surfaces and therefore does not contribute to eye discomfort.

Tests made by lamp manufacturers and by Curtiss-Wright Laboratory (Report MLR 5-48) indicate that the life expectancy of fluorescent lamps, type F-15 (T-8) SW, under airplane vibration conditions, is at least five times

greater than the life of 26 volt Mazda 307 and 305 incandescent lamps. Data show the fluorescent lamps and their starting filaments are rugged enough to withstand vibrations of 0.002 in. amplitude throughout a continuously recycling frequency range of 5-55 cycles per sec, in duty cycles of 15 min "on" and 3.75 min "off," without appreciably diminishing their life.

### New Celanese Plant at Belvidere, N. J.

Celanese Corp. of America has acquired a new plant at Belvidere, N. J., for the production of chemicals, plastics, and related products. Present plans call for an ultimate expenditure of more than \$10 million and employment of about 750 persons in the first phases of operation.

A main building of 100,00 sq ft, a power plant with a capacity of 300,000 lb of steam per hour, a complete sewage disposal plant, and railroad sidings are among the facilities now on the area which comprises 800 acres of land.

Among the products it is planned to produce at the Belvidere plant is the new Celanese plastic "Forticel." Celanese Plastics Corp., wholly-owned subsidiary of Celanese Corp. of America, will sell the products manufactured at the new plant.

### General Motors of Canada to Sell Regina Plant

General Motors Corp. of Canada is abandoning automobile production at its Regina, Canada, plant, and will sell the 40-acre unit to the Ottawa government for \$700,000. G.M. built the plant in 1928 at a cost of \$1.5 million and made cars there for three years, after which it was closed for six years during the depression. It was reopened in 1937 and turned out as many as 10,000 cars a year before it was converted to munitions production in 1941.

### Luscombe Moves to Dallas

Luscombe Airplane Corporation's operations at Trenton, N. J., were transferred to Dallas, a move which consolidates the home office as well as all manufacturing activities of the corporation in Texas.

Transfer of all key personnel for the production of the all-metal Silvaire plane already has been carried out and all operations at Trenton, were absorbed into the Dallas organization by the end of the year.

### Advertising Note

Appointment of MacManus, John & Adams, Inc., as advertising counsel for Bendix-Westinghouse Automotive Air Brake Co. is announced by D. O. Thomas, president.

Kropp Forge Co., Chicago, announces that Foley & Co., New York, will again represent them in the eastern territory.



*"It's always Springtime at our house"*

## AMERICAN COIL SPRING CO.

**DESIGNERS AND MANUFACTURERS  
OF ALL KINDS OF SPRINGS TO MEET  
YOUR PARTICULAR REQUIREMENTS**

COMPRESSION

EXTENSION

TORSION

FLAT

MAIN OFFICES AT  
MUSKEGON



WIRE FORMS

CLOCK

SPIRAL

SALES OFFICES:  
CHICAGO • MILWAUKEE • ST. PAUL • DETROIT

## NEW PRODUCTS

(Continued from page 42)



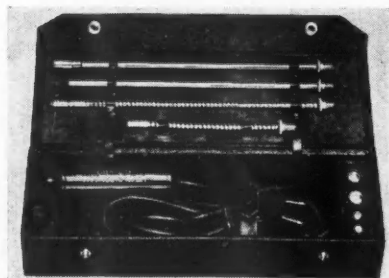
*Federal indicating micrometer*

brought in contact with the work until the indicator hand indicates "O" and the measurement is then read in the barrel and thimble.

As an indicating comparator, it can be set to the nearest thousandth of an in., and the variation from that setting can then be read on the dial.

### Miniature Inspection Lamp

A new miniature inspection lamp, the Eder-Lite, manufactured by Harmon and Co., Chicago, Ill., now makes it possible for inspectors, engineers, mechanics and others whose work requires inspection of hard-to-get-at places, to light up and visually inspect cylinders, gear housings, tubes, rifle barrels, pipes and other equipment that has openings as small as 5/16 in. and recessing interiors.



*Eder-Lite inspection light set*

Small light-reflecting and glareless metal-protected tungsten bulbs attached to flexible or rigid extension make clear vision possible by steering them down the proper channels so that a maximum amount of light is focused on the proper place.

This miniature inspection lamp is manufactured to protect the user against shock by supplying the power through a rubber insulated wire cable to a transformer enclosed in a bakelite handle. Also, in fields where there is

danger of explosion or fire, the Eder-Lite can be had in a special model to provide complete safety in this type of work.

### Two New Spatter-Resistant Welding Compounds

Two new weld-spatter-resistant compounds, No. 9951 and No. 9952, have been formulated by the Electric Welding Division of the General Electric Co.

Both of the new compounds are recommended by the maker for use in the welding field wherever weld spatter is undesirable and must be avoided easily and economically.

Furnished in powder form, ready to be mixed with water, the compounds are identical in performance. The only difference between them is that the No. 9951 is non-adherent and can be readily removed with an air hose or a dry cloth, while the No. 9952 is semi-adherent but can be quickly and easily removed with a damp cloth or a direct stream of water.

A feature of these compounds is that the surface of the work, even if slightly

(Turn to page 68, please)

# CLEAN as a whistle!



Write for new  
free 28-page  
book—  
"Metal Parts  
Washing  
Machines"

... And rarin' to go . . . Your castings and metal parts are ready for finishing after a single run through a Blakeslee Metal Parts washer. Cuts cost, saves labor, production time and cleansing compound . . . Fifty years of experience and 5,000 installations enable us to solve your cleaning problems efficiently and economically. Take advantage of our engineering service.

**BLAKESLEE**  
Solvent Vapor DEGREASERS  
Metal Parts-WASHERS

STANDARD  
AND  
SPECIALS

Engineered  
for you

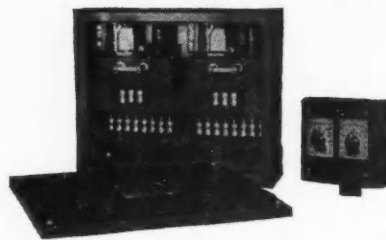
G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS  
NEW YORK, N. Y. TORONTO, ONT.

oily, does not require wetting before they can be applied. Another feature is that a special ingredient in the compounds eliminates the necessity of a water-soluble binder in order to obtain adhesion. Therefore, since the compounds are inert and cannot burn, they are completely smokeless.

#### Repeat Cycle Timer for Machine and Process Control

The repeat cycle timer Type 2T15U, made by Photoswitch, Incorporated, Cambridge, Mass., is an industrial electronic timer designed for machinery and process control. It is suitable for

applications requiring two adjustable timing periods to run in a continuous cycle. This cycle is initiated by either



Photoswitch timer and small dial housing

momentary or sustained contacts, and provision for automatic recycling is provided. Each timing period is adjustable from 1/20th second to two minutes. Control is accomplished through specially designed snap-action relays. Interval variations in repeat cycle timing are less than 2 per cent.

Photoswitch timer Type 2T15U is universal for six maximum time ranges from 1.5 seconds to two minutes for each period of the cycle. Each range is represented by a timing element which is snapped into a clip on the front of the control. The timer may be then set for any intervals up to these maximums by dials which are located either on the timer itself or in a small housing at a more convenient location.

## Start your New Year Right...



2 to 3 weeks delivery

### ...trade in your worn gage blocks on new ELLSTROM Chromium Plated Blocks..

Send us your worn gage blocks and we will replace them with brand new *Ellstrom* Chromium Plated Blocks (rectangular). On the blocks originally manufactured by us a credit of 20% will be allowed. On all other makes of gage blocks we allow a 10% credit and in addition you may keep your old blocks until we deliver the new. Write today for price list.

**SAVE  
UP TO 20%**



**DEARBORN GAGE CO.** 22037 BEECH STREET  
DEARBORN, MICHIGAN

*Originators of Chromium Plated Gage Blocks*

#### Non-Hazardous Bright Dipping

Waverly Petroleum Products Co., Philadelphia, Pa., has developed several Troxide bright dip formulas which are said to eliminate the hazards present in the conventional bright dip formula consisting of sulfuric acid and nitric acid.

It is said that with Troxide bright dip formulas none of these hazards are present—there are no offensive fumes, the solutions are easy to prepare, and the danger of accidental splashes on the skin is eliminated.

#### Cherry Blind Rivets Now Made in Larger Sizes

To meet the need for larger diameter blind rivets, three new diameters, 7/32 in., 1/4 in. and 9/32 in. are now being produced by the Cherry Rivet Co. of Los Angeles. These rivets are available in the three standard Cherry rivet types, self-plugging, regular hollow and pull-through hollow; in modified brazier and 100 deg countersunk heads; in A17ST or 56S aluminum alloy, and in steel.

To install these larger rivets, a pneumatic-hydraulic Cherry rivet gun, the G-40, is now being manufactured. It operates on from 75 to 90 lb air line pressure, is 13 in. high and weighs seven lb.

#### Coolers for Corrosive Gases and Liquids

"Karbate" sectional cascade coolers, designed for the efficient cooling of corrosive liquids and gases, are now available from National Carbon Co., Inc., New York. A complete cooler assembly is easily erected from four standard items in five pipe sizes and is adaptable to a wide range or process requirements. Construction is such that additional units, or sections, may be added just as one would stack office filing cases.

Having the properties of "Karbate" impervious graphite materials such as corrosion resistance, high heat transfer rate, resistance to thermal shock and freedom from corrosion scale formation, "Karbate" sectional cascade coolers are

(Turn to page 70, please)





## We have reversed the design ... but NOT the principle

Users agree that the Bryant principle of cylindrical slide construction is ideal for the fast, precise, economical production of internally ground parts. Bryant engineers knew that this same principle, applied under the work head, would be more practical for certain types of jobs. The result was the Bryant No. 112. This result has been tested and proved for the past five years.

The No. 112 is the last word for the internal grinding of tool room and small lot parts. It is designed with simple, concentrated controls — tooling and fixtures may be changed quickly — production is extremely fast — accuracy and work finish are among the finest ever produced by any grinder of any type. To help determine the value of the Bryant No. 112 on your work . . .

*Send for the man from Bryant.*

**PHANTOM VIEW OF  
BRYANT No. 112**



# BRYANT



**CHUCKING GRINDER CO.**  
SPRINGFIELD, VERMONT, U. S. A.

## "Plane Torque" for Ground Work



Manufacturers, when reconverting, cannot fail to grasp the significance of the war-born advances in precision-tightened assembly. Makers of motors, refrigerators, radios, washing machines, etc., are using torque tightening in assembly, inspection and repair. Foremost among the hand tools performing this function is the JOMI torque wrench of Army Air Corps fame.

### Precision Construction Builds Customer Confidence

Superior products, built with JOMI, will outsell and outlast those made by the old, uncontrolled method.

The dealer's service agency, using the factory manual on specific torques, insures 100% return business to factory agencies with this expert "know how."

### The JOMI is Instantly Self-Converting

The JOMI torque wrench is instantly adjustable on the job. To adjust simply turn the micrometer guide on the barrel. (Two JOMI models range from 5 to 100 in./lbs., and 100 to 750 in./lbs.) Quick, fool-proof, the JOMI automatically breaks when predetermined torque is reached. No taps to feel, no clicks to hear, no dials to watch. Used with any standard head or socket, the mechanic consults his manual, sets his JOMI, locks it and tightens to specifications, tension automatically breaks...and the result is a PERFECT JOB.



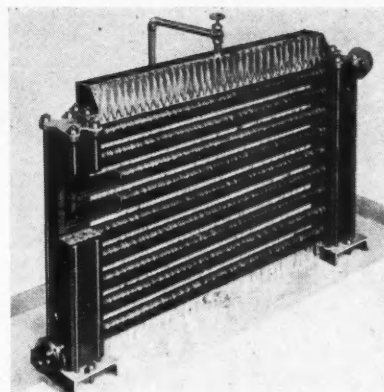
GI (Good Intentions) JO says:  
"No retooling, no fooling." Use a

# JOMI

## TORQUE WRENCH

*for unerring skill in Assembly Inspection Service*

**JO MANUFACTURING COMPANY**  
South Gate, California



**Karbate sectional cascade cooler**

recommended by the maker for service in practically all acids, caustics and organic solvents at pressures up to 75 psi and temperatures up to 338F. Minor changes in the method of applying the cooling water permit the handling of gases well in excess of this temperature.

### Fire Extinguisher with Quick Operating Features

A carbon dioxide hand fire extinguisher with unique design and quick operating features developed during the war is now being delivered by the B. F. Goodrich Co., Akron, Ohio.

Made to meet the full approval of fire underwriters, the container holds four lb of carbon dioxide and comes



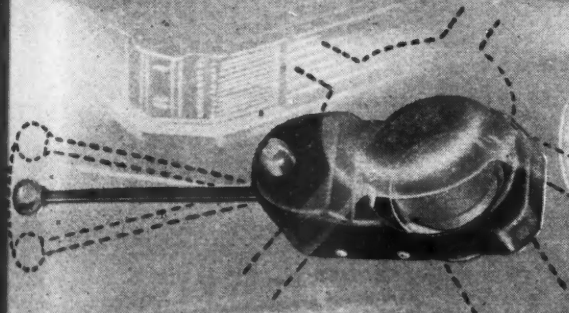
**Carbon dioxide fire extinguisher  
made by B. F. Goodrich Co.**

with a carrying handle and control button designed for fast operation. It can be easily carried in one hand, with the thumb of the carrying hand operating the push button. A horn swivel raises or lowers as needed, remaining in lower position when attached to the wall rack furnished with each extinguisher, together with a quick release chain.

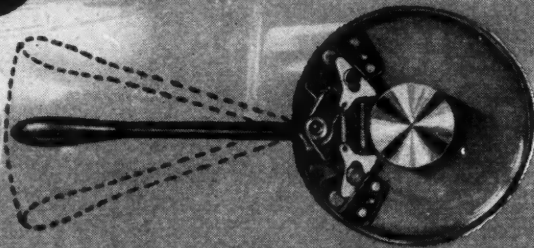
(Turn to page 74, please)



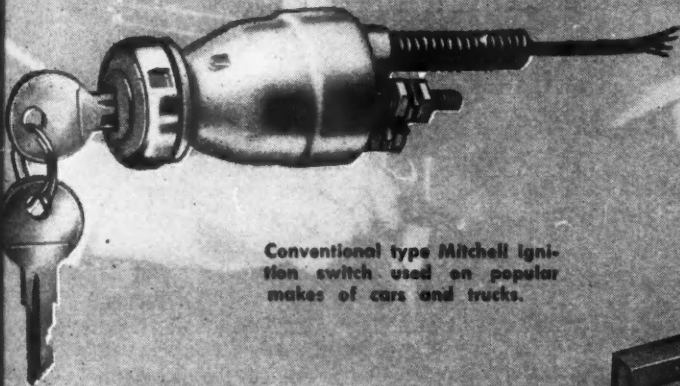
# Products for Peace!



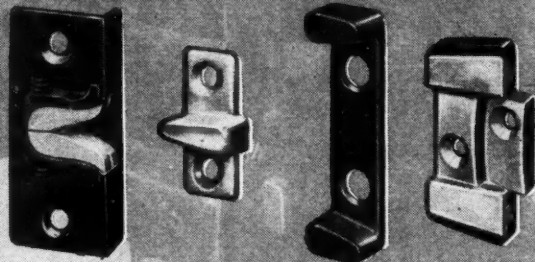
New Mitchell clamp-on semi-automatic directional signal switch designed especially for trucks.



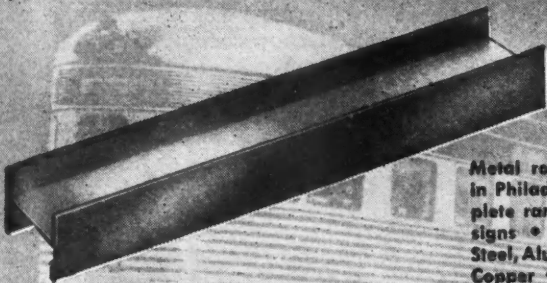
Mitchell built-in type semi-automatic directional signal switch used in certain makes and models of cars—universal use on cars of the future.



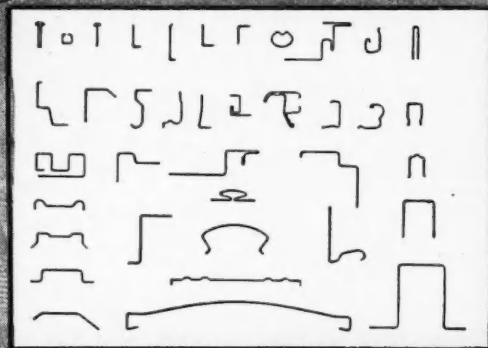
Conventional type Mitchell ignition switch used on popular makes of cars and trucks.



Two popular styles of dovetails used on automobile and truck doors.



Metal rolled shapes produced in Philadelphia plant—complete range of Metals • Designs • Gauges • Stainless Steel, Aluminum, Brass, Bronze, Copper • Cold rolled, drawn and pressed • Automobiles, Airplanes, Architectural, Railroad cars, Radios, All industrial uses.



Air cleaners for military trucks, tanks and power units, for farm machinery and industrial tractors, poured out of our Chicago plant during the last three years to the tune of almost 5,000,000 units.

From our Mitchell plant, amazing quantities of bomb fins, rifle grenades and other war goods emerged side by side with ignition switches, automotive control units and intricate rolled shapes

and other products essential to the maintenance of wartime activities.

With our resultant increased production capacity, expanded manufacturing facilities and intensified engineering experience, we are equipped to serve the automotive, agricultural and industrial power industries in our specialized fields with better products than at any time in our 25 years' history.

## UNITED SPECIALTIES COMPANY

United Air Cleaner Division, Chicago 28—Mitchell Division, Philadelphia 36





Bore gage made by Chrome Gauge Corp.

### Bore Gage Uses Electronic Principle

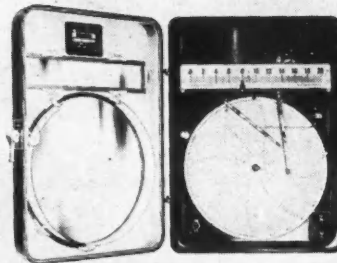
A new electronic bore gage utilizing direct contact to measure the diameter of tube, gun and other cylindrical interiors, will be introduced soon by the Chrome Gauge Corp., Philadelphia, Pa.

The new gauge, comprising a projection rod mounted on a stabilized frame and containing a delicate, flexible point, is inserted into a bore where it checks by contact all interior surfaces. The results of the test are transmitted instantaneously to a Brown Electronik precision indicator. This instrument,

featuring continuous balance, picks up and indicates various imperfections, air pockets and other unwanted conditions to .00005 in.

### Input Controller and Recorder in One Case

The Bristol Company, Waterbury, Conn., has recently placed on the mar-



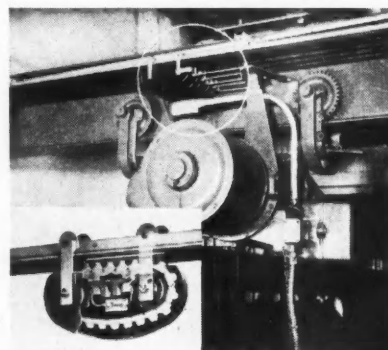
Bristol electric-type controller

ket an electric-type controller which combines a proportional current input controller and a recorder in one case. Designed to provide accurate control of electrically heated furnaces and ovens, this new instrument provides on-and-off type control with the advantages of proportioning control.

A rotating cam interrupts the flow of current to the heating coil or coils the duration of which is determined by the departure of the controlled temperature from the control point.

### Fully-Insulated TracTroly

The fully rubber-insulated TracTroly, a recent development of the Benbow Manufacturing Co., San Francisco, Cal., is suitable for virtually every type of electrically operated mobile equipment, such as cranes, monorails, portable tools, etc. This system meets safety

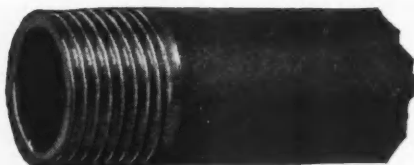


Rubber-insulated TracTroly

code requirements which prohibit unguarded conductors.

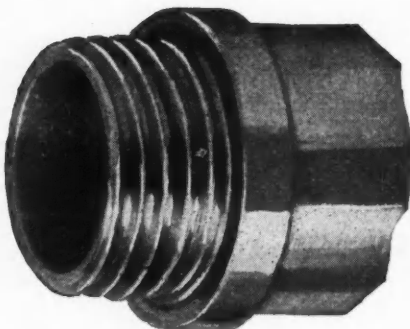
The TracTroly system consists of a copper conductor in standard 10-ft lengths encased in a slotted rubber rack supported by a rigid backing, and individual traveling collectors which employ an endless chain, like a tractor tread, to effect six-tooth multiple contact at all times. Arcing and pitting, as well as fire explosion hazards, are said to be eliminated.

## WEDGE *can...* ROLL THREADS on tube, pipe or parts too THIN for cutting..



The WEDGE process of rolling threads can be used by many. In many places thin wall parts or tubing can be used with considerable saving in both weight and costs. Our new exclusive process does a perfect job and is very rapid—can produce up to 1000 per hour depending upon the size. We can also roll threads on heavy tubing or parts far more efficiently and cheaper than by present methods. Consult WEDGE Engineers on any threading problem—they can reduce costs.

We can roll thread, inside or outside, on steel, brass, copper, aluminum and magnesium tubing of any length—V, acme, round or square threads.



SIZES—1/2" dia. to 6" dia.  
Wall Thickness—.020 to 1/4"  
Pitch—from 30 pitch x .020 wall to  
4 pitch x .062 to 1/4" wall

Michigan Representative

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Phone Madison 5300

Write for further information

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Use WEDGE Chill Rings-Thread Protectors

**Leonard Refineries, Inc.**

Alma, Michigan

# ...another source of higher-quality motor fuel

Leonard Refineries, Inc., of Alma, Michigan, becomes the seventeenth Houdry licensee and will shortly construct the 69th Houdry licensed catalytic cracking unit. It will be a 3,000 b/d TCC unit—the first catalytic cracking unit of such small size to be built by private capital for post-war motor gasoline production.

As the war's end approached, Leonard foresaw that expected developments in automotive engine design would call for greatly improved motor fuels such as they could produce only by the addition of catalytic cracking facilities. With characteristic thoroughness, the company's officials carefully considered the merits of all catalytic cracking processes, paying particular attention to their suitability for an operation of relatively small size.

After exhaustive investigation, Leonard chose TCC, joining the following distinguished company of Houdry licensees who represent nearly two-thirds of America's catalytic cracking capacity:

American Liberty Oil Company

Ashland Oil & Refining Company

Continental Oil Company

Crown Central Petroleum Corporation

General Petroleum Corp. of California

Gulf Oil Corporation

Leonard Refineries, Inc.

Magnolia Petroleum Company

The Pure Oil Company

Richfield Oil Corporation

Sinclair Refining Company

Socony-Vacuum Oil Company, Inc.

Standard Oil Company of California

Standard Oil Company (Ohio)

Sun Oil Company

Tide Water Associated Oil Company

Union Oil Company of California

## HOUDRY PROCESS CORPORATION

WILMINGTON, DELAWARE

NEW YORK OFFICE: 115 BROADWAY, NEW YORK 6

Houdry Catalytic Processes and the TCC Process are available through the following authorized firms:

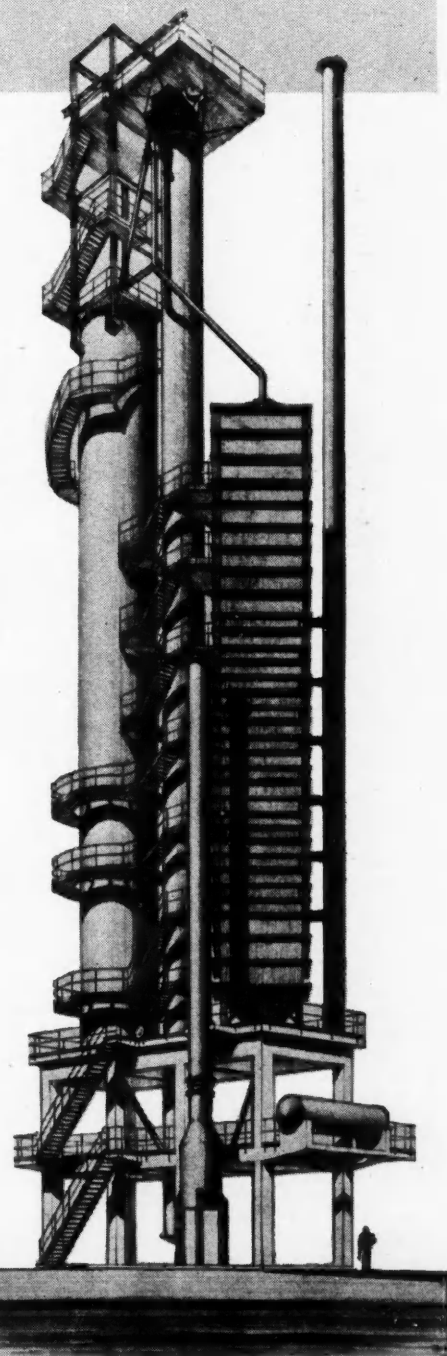
E. B. BADGER & SONS CO.  
Boston, Massachusetts

THE LUMMUS COMPANY  
New York City, New York

BECHTEL-McCONE CORP.  
Los Angeles, Calif.

**HOUDRY**  
CATALYTIC  
PROCESSES

FOR VICTORY IN WAR  
AND PROGRESS IN PEACE



# Production of Magnetos

(Continued from page 22)

The impulse coupling as used on the Fairbanks-Morse magneto is actually a separate mechanical assembly. It is made of a shell, drive spring and hub. The shell is a steel forging, this method of manufacture having been found to possess numerous advantages over other commonly used processes. The rough forgings are machined on small turret lathes, after which the drive lugs are cut on milling machines. Hubs

are hydrogen-brazed assemblies of collars produced on the automatics, and plates punched from heavy steel. This assembly is also machined on turret lathes. When completed, both shells and hubs are heat-treated in a modern Ajax salt bath furnace. Shells are then ground to close tolerances and are turned over to the inspection department, while additional operations on the hub add the pawls, pawl rivets and

pawl springs. After inspection, the coupling parts are assembled and added to the magnetos on the test floor.

Quality control is a vital part of the process since careful acceptance procedure has a marked influence upon the facility of assembly and freedom from rejects. Thus we find painstaking inspection at every stage of the process. The rotors are carefully checked before going to assembly. The frames are inspected visually and dimensionally before being cleared. And the same holds for the other parts, large or small.

Having made a quick high-spotting of some of the manufacturing steps, we are ready to take a look at the assembly and final inspection of the finished magneto. Assembly operations are handled on a group of benches over which the work flows smoothly from one station to another. All of the assembly is done by women whose dexterity is indispensable in the handling of tiny parts and small sub-assemblies. Here again the amazing volume of work that is turned out in a relatively small department is explained by the basic principle of careful planning and sound design. The combination of simplicity of design and a minimum number of parts and sub-assemblies has much to do with the facility of work movement along the assembly stations. The value of interchangeability of parts and careful quality control also plays an important role.

The number of sub-assemblies that have to be made up on the assembly bench is small, the major ones being the bearing support, distributor housing, and the rotor. These are fed to the final assembly benches and integrated rapidly. Just before the final assembly is completed the rotor magnets are charged right at the operator's station. Each of the operators at this station has an electro-magnet at the side of the bench, the rotors being placed in the fixture and charged under automatically controlled conditions. At the end of the line each magneto is adjusted and calibrated for proper timing with the aid of a special synchroscope.

Following the synchroscope test the units are taken into the adjoining room where they are subjected to a running test. The testing equipment, illustrated here, accommodates 1200 magnetos at a time, each one being thoroughly tested. Upon acceptance after completion of the running test, each unit is partially dis-assembled and given a visual inspection, then re-assembled and retested for performance and calibration with a synchroscope.

Despite the several inspections of a finished magneto there is still another test on a large synchroscope before the machine is accepted as suitable for shipment to the customer. This test covers a careful check on breaker timing, on the operation of the impulse coupling, and final visual inspection before packing.



**T**HERE'S a race on—for markets, against finely trained fast-stepping competition. Are you ready?

Many alert manufacturers have talked over their problems—with Aetna; have found practical ways to improve both their products and their equipment by use of more bearings, or better suited bearings; are already in the pink of condition for a gruelling contest.

Aetna can help you plan right now; and faced by no reconversion problem, we can start making bearings for you as soon as our war production obligations, rapidly diminishing, have been finally discharged.

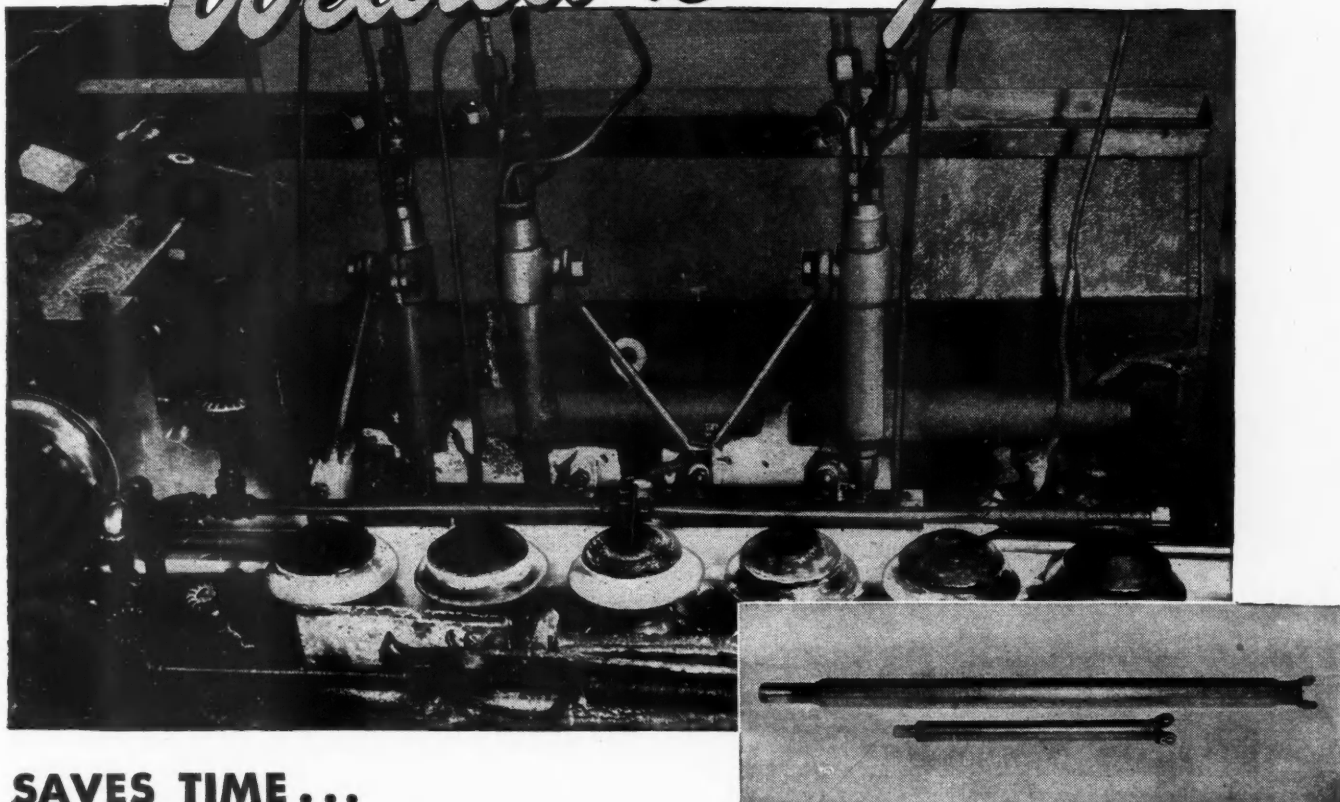
Better call Aetna. Aetna Ball and Roller Bearing Company, 4600 Shubert Avenue, Chicago 39, Illinois.

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ORIGINATORS OF MODERN OXYACETYLENE FLAME AND ELECTRIC ARC METHODS FOR METAL FABRICATION



# Investigation of Fluoroscopy

(Continued from page 30)

## Theoretical Evaluation

The striking improvement in fluoroscopic sensitivity caused by increasing the screen brightness by a factor of about nine made it desirable to correlate this fact with an analysis of the physical and physiological factors involved. It was found possible to do this in a simple way. An overall contrast factor  $C$  related to the percentage sensitivity  $S$ , e. g., determined with step wedges, by the relation  $C = 1.5/S$  can

be compounded as a product of three component contrast factors as follows:

In radiography:

$$C = C_x S C_e,$$

in fluoroscopy:

$$C = C_x C_f C_e,$$

where  $C_x$  is the X-ray contrast factor,  $C_f$  the film contrast factor,  $C_e$  the screen contrast factor and  $C_e$  the eye contrast factor. Variations in thickness of the object being radiographed or fluoroscoped undergo several trans-

formations before they are viewed by the eye as variations in brightness.

First, the variations in thickness are transformed into variations in intensity of the X-ray shadow of the object.  $C_x$  describes the way in which percentage variations of X-ray intensity after passing through the object vary with percentage variations of thickness. Second, the variations of X-ray intensity are transformed into variations of physical brightness of the screen in fluoroscopy or the brightness of the properly illuminated film in radiography. Usually the screen brightness is directly proportional to incident X-ray intensity so that  $C_e = 1$ .  $C_f$  is equal to the gamma of the film at the density level used. The third stage in either radiography or fluoroscopy consists of transforming brightness variations of either the illuminated film or the fluorescent screen into variations of brightness sensation in the eye. This transformation is determined by the ability of the eye to recognize variations of brightness at the brightness level at which the screen or film is viewed. If the brightness level is higher than about 15 millilamberts all the physical contrast is actually seen by the eye, and  $C_e = 1$ . This is the case for a well-illuminated radiographic film. At lower brightness levels the eye does not see as well. Its lowered brightness discrimination capacity can be described by  $C_e$  being less than 1. Fig. 7 shows how  $C_e$  varies with brightness. This curve is obtained from the well-known brightness discrimination curve.<sup>1</sup>

Fig. 8 shows some experimental and theoretical values of  $C_x$  for aluminum.  $C_x$  increases with thickness. For a thickness of  $\frac{1}{2}$  in. of aluminum it is a little more than 1 for the voltage range used in radiography and fluoroscopy. In radiography the overall contrast attainable using film of gamma equal to five is therefore:

$$C = C_x C_f C_e = 1 \times 5 \times 1 = 5$$

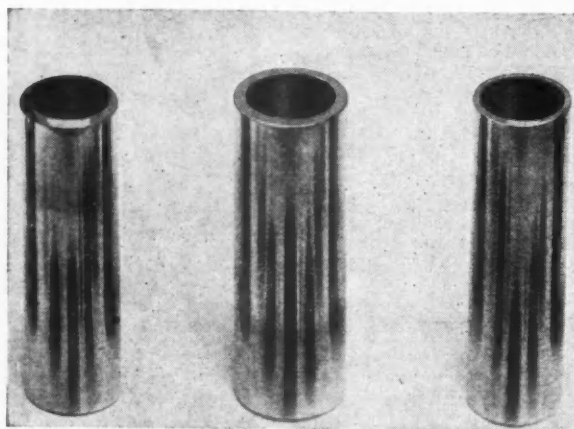
or  $S = 0.3$  per cent

In ordinary industrial fluoroscopy such as in the field tests with the tube at 20 in.  $C_e$  will be in the range from 0.1 to 0.2, thus  $C = C_x C_f C_e = 1 \times 1 \times (0.1 \text{ to } 0.2) = 0.1 \text{ to } 0.2$ , and thus  $S$  will be in the range from 15 to seven per cent. In fluoroscopy under optimum conditions with a short tube distance yielding higher screen brightness  $C_e$  will be greater than 0.5, thus making  $C > 1 \times 1 \times 0.5 > 0.5$  and  $S$  less than three per cent.

The sensitivities calculated for a total thickness of aluminum of  $\frac{1}{2}$  in. are sensitivities for brightness discrimination between large areas with sharp boundaries and where no glare effects exist. It is seen that the steepness of the  $C_e$  curve in the range of brightness attainable fluoroscopically is responsible for the large increase in observable contrast obtained by moving

<sup>1</sup> e.g., Mies, The Theory of the Photographic Process, MacMillan Co., p. 804.

(Turn to page 82, please)

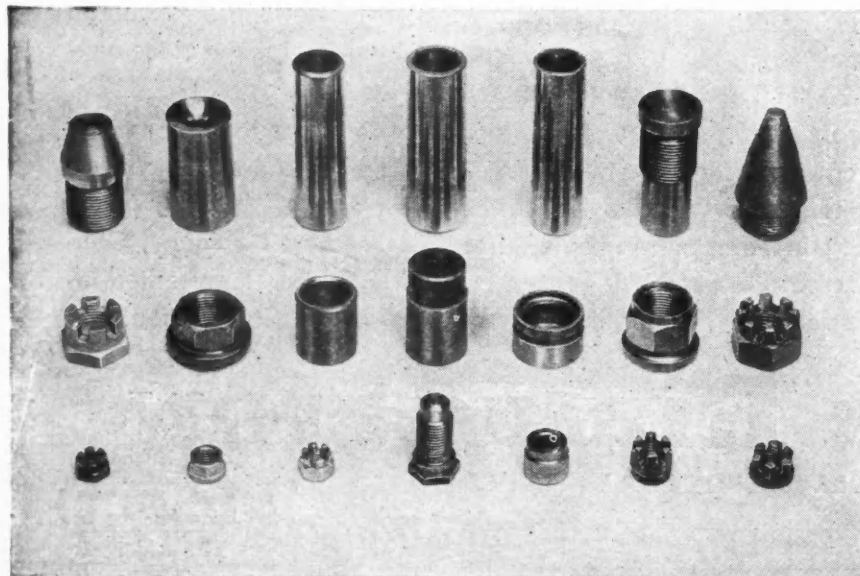


These are samples of precision parts (illustrated below) of ferrous and non-ferrous alloys that have been made by Bessemore. On each of them, the screw machine work was completed within ten and twenty-five seconds and .002" tolerances were maintained. The grinding work is held to .0001" (tenth).

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**BESSEMORE** specializes in precision screw machine manufacture . . . making more of them better. Our engineers will be glad to make recommendations without obligation . . . send us your blueprints.

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FOR OTHERS**

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the focal spot of the X-ray tube from a distance of 23 in. from the screen to a distance of eight in. It is also seen that even at best fluoroscopy cannot compete with radiography when ultimate contrast is required. This is because the X-ray film is a contrast amplifier while the fluoroscopic screen is not.

The C. curve shows that doubling the physical brightness, say by doubling the X-ray tube current, only gives a slight gain in the eye contrast factor even where the curve is steepest. This fact has been verified by using the artificial test specimens with a commercial fluoroscope that could be operated at a maximum tube current of 15 ma. There was very little difference in performance at eight ma and 15 ma. Therefore, it would seem that no appreciable advantage can be obtained by use of the much more costly X-ray equipment needed for operation at a tube voltage of 160 kvp and a tube current of 15 ma. To get enough increase in brightness by raising the tube current is impractical on account of the large increase in power and the corresponding amount of heat to be dissipated at the target. Furthermore, with the higher tube current the focal spot must be made larger. The short tube distance and higher voltage seems to be the only available method of increasing the screen brightness with screens available at the present time. The possibilities of using equipment at a voltage greater than about 150 kvp have not been explored. The evidence seems to be that above a voltage of 150 kvp the screen brightness of a Patterson B or B industrial screen does not increase very much when used with thin aluminum sections, but an appreciable gain is obtained with thicker sections due to the increased penetration of the thicker parts. The possibility of sensitizing screens for greater efficiency at higher voltages would appear to offer a means of improvement, but this has not been investigated.

#### Limitations

The short distance tube arrangement has two disadvantages along with another big advantage other than the production of higher brightness. The first disadvantage is the smaller field of view as limited by the portal system of the tube. The decrease in field diameter prohibits the use of tray-focal spot distances of much less than five in. except in special cases as in the examination of very small castings. With the tray-focal spot distance equal to five in. and the screen three in. above the tray bottoms, the diameter of the field on the screen is about seven in. with one side cut off slightly by the target shadow. A large proportion of aircraft castings require a greater object-screen distance in order to enable the object to clear the screen. The greater screen distance gives a bigger apparent field of view on the screen. It is desirable to use the screen at the closest position

(Turn to page 85, please)

that the castings would safely clear.

The second disadvantage is the noticeable fuzziness of the shadows of defects not close to the screen. This fuzziness is due to the size of the focal spot and would become much worse with a spot larger than the 2.4 mm used in the tests discussed. Frequently, it is worthwhile to turn the castings over for a second view. However, the fuzziness does not seem to affect adversely the ability of the observer to see the presence of a defect, but only interferes with the observation of the details at the boundaries. This makes it difficult for the observer to judge whether a cavity is a gas hole or dross pocket.

### Rotational Effect

A particularly significant advantage is derived from the use of a short focal spot-object distance. A small relative motion of the casting with respect to the focal spot of the tube causes a large rotational distortion effect on the shadow of the casting on the screen. The geometrical distortion does not seem to bother the observer in any way, but the rotational effect enables the observer to see many defects that would be missed in a single view. Defects hidden by ribs, lugs, and other heavier sections are made visible on the screen by the apparent change in position or rotation of the casting. The motion of the trays relative to the tube produces the rotational scanning in one direction. A rotational scanning in the direction at right angles to the tray motion is obtained by mounting the X-ray tube on a rack as shown in Fig. 9, so that it can be moved six in. by means of a handle accessible to the observer. This motion has been of the greatest aid in picking up defects. Tests have shown that in all but the simplest castings an appreciable proportion of good-sized defects can be detected by this method which would otherwise have been overlooked on radiographs involving even several views.

### Comparison of Fluoroscopy and Radiography of Castings

The most recent phase of this investigation consisted of installing the improved fluoroscope at three X-ray laboratories where a large selection of castings were available and where comparisons between fluoroscopic and radiographic findings could be conveniently made. The main trend of the results of examining approximately 10,000 castings with over 14,000 defects confirm the previously mentioned considerations.

1. The fluoroscope does not show very large numbers of very small defects that can be seen on the radiographs.

2. The fluoroscope using rotational scanning shows a surprisingly large number of medium and larger defects that are not detected radiographically. It is seen that the utility of fluoroscopy depends on other considerations as to where to draw the line between rejectable and acceptable defects. While

the specific limitations of fluoroscopy have not been established, it is clearer as to the general range of limits which may be expected. It is hoped that continued work may assist in establishing these limits more definitely.

### Advertising Note

William A. Blees, formerly vice-president and Pacific Coast manager of Young and Rubicam advertising agency, has been appointed vice-president in charge of sales for Consolidated Vultee Aircraft Corp. Mr. Blees also will serve on the sales committee of The Aviation Corp., parent company of

Consolidated Vultee. Since 1942 he has been in charge of the Convair advertising account for Young and Rubicam.

### Chicago and Southern Buys Douglas DC-4 Airliners

The first of a fleet of four-motored 56 passenger Douglas DC-4 airliners has been acquired by Chicago and Southern Air Lines and will go into service over the company's network of sky routes on April 1, 1946, it was announced by Carleton Putnam, president, from the company's general offices at Memphis, Tenn.



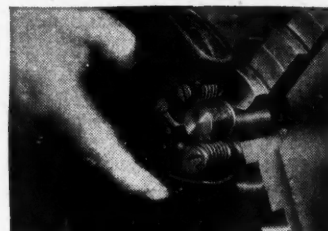
### New Comparator Gage Saves Time — Gives 6 Inspections in One!

Even the most inexperienced operator can obtain accurate inspection of externally threaded parts, with the Limitrol Comparator Gage—in many instances, increasing the rate of inspection as much as 400%. The Limitrol, proved in hundreds of war plants, permits 6 visual checks in one: pitch diameter, lead, taper, out-of-roundness, angle, and straightness. Its use reduces inspection and production costs, cuts scrap waste while increasing speeds of operation. If a part passes the Limitrol, it will assemble accurately.

Graduated dials are furnished as standard equipment. These dials are graduated in increments which approximate .0005 inch when the magnification is 250 to 1, and serve as a guide in determining just how far over or under the limits the part might be.

Another "help on the job" is chewing gum. Chewing seems to make work go easier, time go faster. Good chewing gum is available, but there's still a shortage. That's why we at Wrigley wish we could make Wrigley's Spearmint now, to help increase the available supply. You may be sure we will, just as soon as sugar restrictions are lifted. Meanwhile, chew any good available brand, because it's the chewing that really does you good.

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Hand Model used for "in process" gaging



AA-51



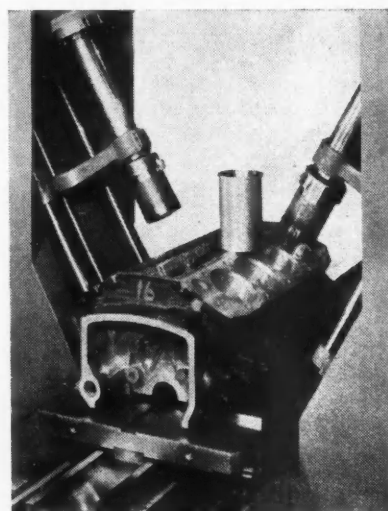
## New Process for Cylinder Sleeves

A SET-UP combining cold treating, heating, and hydraulic presses for assembling eight steel sleeves in the bores of a V-type cylinder block has been in use by a well-known engine manufacturer, the process being worked out in cooperation with Colonial Broach Co., which designed and built the special assembly presses for the operation.

The steel sleeves are cold-treated by refrigeration at the same time the blocks are being heated. The chilled sleeves are pressed in two at a time

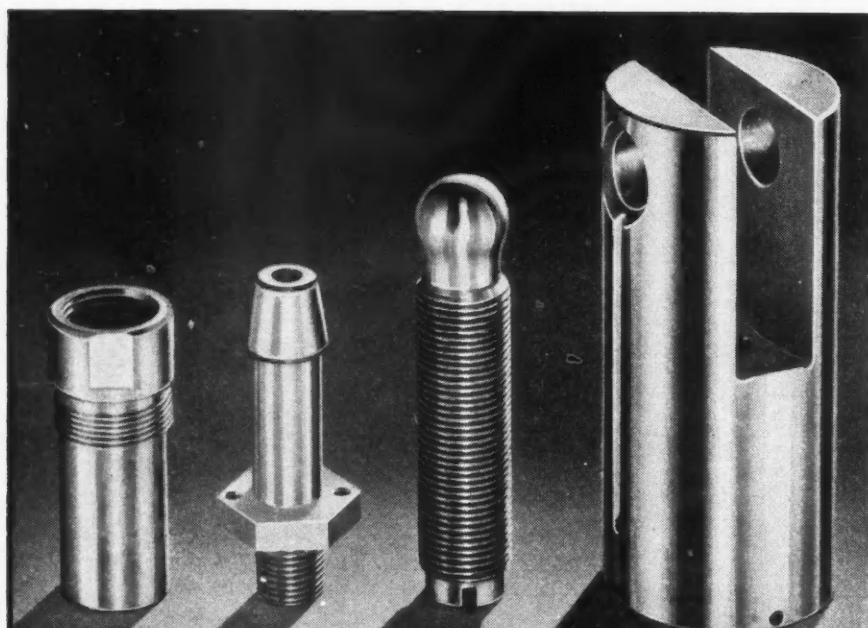
on a dual Colonial press as shown in the accompanying photo. The cylinder block is indexed into position for each subsequent pair of sleeves. Spring loaded plungers which contact index grooves on the side of the fixture slide, insure alignment.

When block and liners return to room temperature after this operation, the liners develop a tendency to "crawl" up out of the bores. It thus is necessary to "set" the sleeves after cooling. For this there is another press, providing a combination of hydraulic pres-



*Colonial press which forces in two sleeves at a time*

sure and impact. The platen is inclined so as to automatically align each row of bores with the plunger of the press. Locating stops in the raised strip on the platen position the cylinder block for each sleeve.



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### B. F. Goodrich Chemical Co. Acquires Hycar Assets

B. F. Goodrich Chemical Co. has acquired the assets of the Hycar Chemical Co. Physical assets and trade names of Hycar are now owned by B. F. Goodrich Chemical Co., and all Hycar products will be marketed by the new owner.

The synthetic rubbers manufactured by the Hycar plant in Akron, Ohio, were developed in 1937 and were said to be the first of their type manufactured on a commercial scale in this country. This plant also produced the man-made material used in the first synthetic tire sold commercially in this country in 1940, in which more than 50 per cent synthetic rubber replaced the natural product. During the war years Hycar was jointly owned and operated by The B. F. Goodrich Co. and Phillips Petroleum Co.

The new Hycar headquarters will be in the company's main office in Cleveland. Production will continue in the company's synthetic rubber plant in Akron.

### Chrysler Pays Bonus to Hourly-Rated Employees

Chrysler Corporation paid year-end bonuses totaling \$3,245,715 to 41,316 hourly rated employees in lieu of vacation pay, according to a company announcement. A bonus has been paid annually since the stipulation was written into the union contract in 1940. The payment was made this year, even though the union was without a contract when the bonus was paid.



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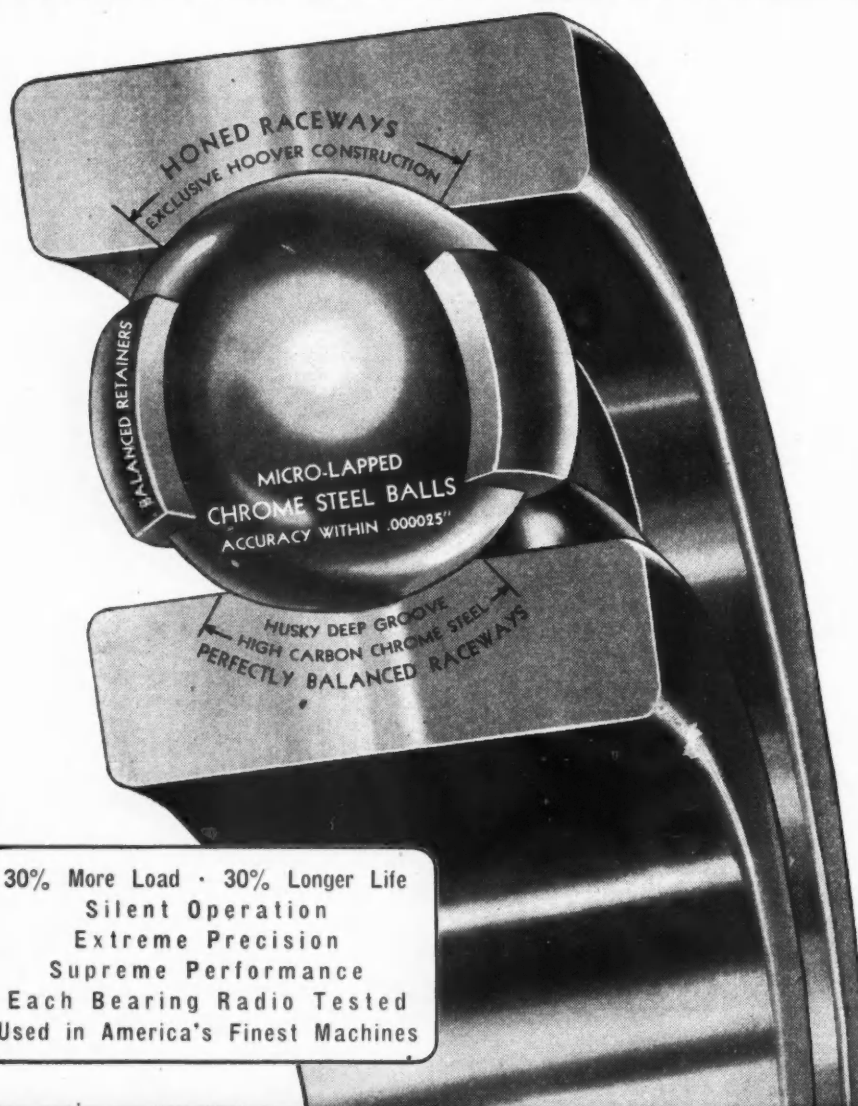
(Continued from page 15)

succeeded here because the American approach was unique.

If you examine the methods used by those early American industrial enterprisers and contrast them with the European experiments in the art of mass-production you will find this first significant clue to America's strength. Because class distinctions were repugnant to the American people, this

nation's industrial pioneers sought their customers, not among the "class trade" as it is known in Europe, but among the masses. Mass production succeeded here because it was set up to serve the people in general, because it was considered as production *by* the masses for the masses. That approach was different. It showed up early in our history, in several ways.

## *So much more...for so little more.* AMERICA'S SUPER FINE BALL BEARING



30% More Load • 30% Longer Life  
Silent Operation  
Extreme Precision  
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Each Bearing Radio Tested  
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So, one of the things that makes us Americans different is the notion we have always held that mass production is production *for* the masses, a notion which, though still seemingly fantastic to non-Americans, has become a solid tradition with us because it has worked successfully, to the profit of all of us. We have learned by a century of experience that it pays, and pays well, to operate a business that serves the public as it wishes to be served.

In that constant striving to capture the public favor by rendering it the service it wants, we have become a nation of intensely competitive people. That is our other distinguishing quality. Foreigners cannot understand why we are so keenly interested in competition.

It is these two qualities, our love of competition and our unique approach to the mass-productive arts, which not only set us apart but make us strong.—*From an address before the Automotive Council for War Production.*

### Diesel Association Elects Officers

E. J. Schwanhausser, vice-president of Worthington Pump & Machinery Corp., was elected president of Diesel Engine Manufacturers Association at the association's annual meeting, recently held in Chicago. Gordon Lefebvre, president of Cooper-Bessemer Corporation and J. E. Peterson, vice-president of General Machinery Corp., were elected vice-presidents of the association. Re-elected as treasurer was Robert H. Morse, Jr., vice-president and general manager of Fairbanks, Morse & Co. Harvey T. Hill, executive director of Diesel Engine Manufacturers Association, was likewise re-elected to serve through 1946.

### Steel Production Rate

According to the AMERICAN IRON AND STEEL INSTITUTE, the operating rate of steel companies having 94 per cent of the steel capacity of the industry was 83.0 per cent of capacity for the week beginning Dec. 17, compared with 82.4 per cent one month ago and 96.3 per cent one year ago.

This represents an increase of .1 point or .1 per cent from the preceding week.

The week's operating rate is equivalent to 1,520,300 tons of steel ingots and castings, compared to 1,509,300 tons one month ago, and 1,732,400 tons one year ago.

### Aeronautical Products Consolidates Plants

Aeronautical Products, Inc., announces that henceforth the company's manufacturing program and executive offices will be consolidated at its plant in Washington Court House, Ohio. The change will not affect the Detroit office which serves customers in that area. The transfer of all equipment at the Detroit plant has been completed.

## DISC BRAKES THAT END

## BRAKE ADJUSTING

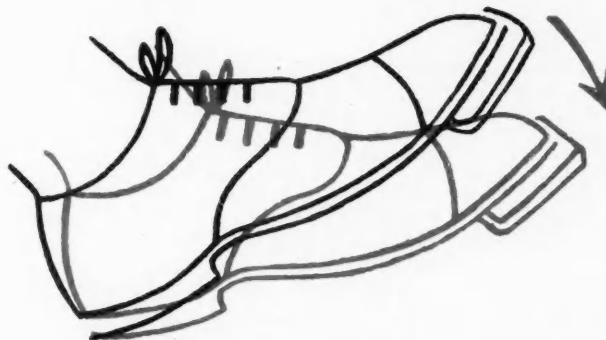
## and PEDAL GYMNASTICS

## and practically end

## CAR BRAKE RELINING



POWER DIRECTLY APPLIED



TOE-TIP CONTROL

Among the Lambert Air-Disc Brake advancements that will be welcomed by the men who buy, operate and drive cars, buses, trucks and tractors, are revolutionary developments in relining, adjusting and operating.

EACH side of a Lambert brake disc is faced with brake material; TWICE the conventional brake area means that a reduction in brake size can be effected, weight reduced, and lining life greatly increased. (Lamberts are good for 100,000 miles on passenger cars, without relining—which is farther than most people drive their cars.) Having no brake drums, Lamberts end drum scoring, brake drag, and the gas waste resulting from having to move heavy brake drums.

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the Lambert brake disc, not through intermediate mechanisms. This means fewer parts, permanent brake adjustment, positive, no-lag performance, and less unsprung and centrifugal weight than conventional brakes.

With Lamberts, gas and brake pedals are side-by-side, at the same floor level. The result is elimination of gymnastics between pedals at different levels. And since controlled air power does the work, next-to-no foot movement and pressure is required in braking. Both improvements lessen driver fatigue and increase safety.

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*Air • Hydraulic • Mechanical*

Products of a Division of the Auto Specialties Mfg. Co.  
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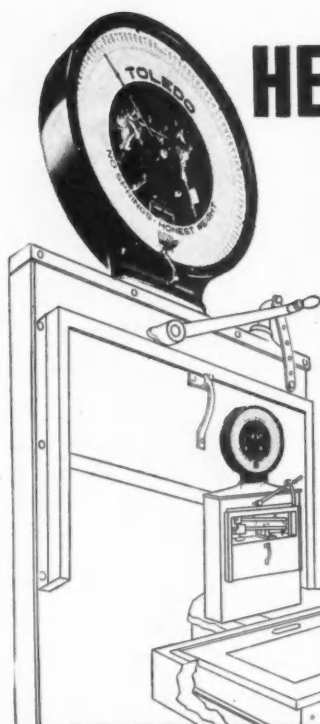
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January 1, 1946

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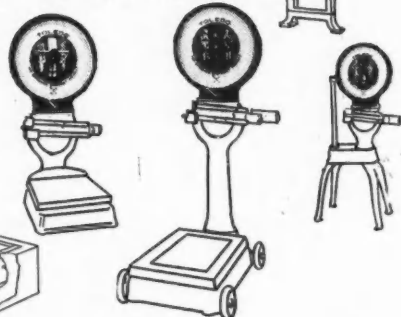
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# TOLEDO

## HEADQUARTERS FOR SCALES

### Aircraft Products

(Continued from page 39)

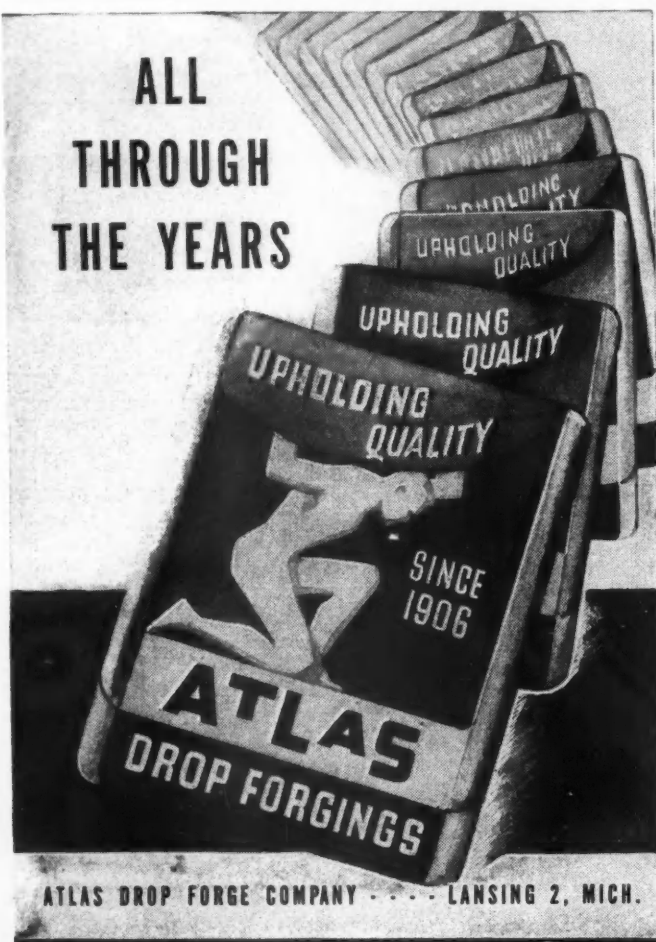
If the plane drops too fast, it enters the area where the pilot sees the red beams. If it approaches too high, the pilot sees the amber beams. But if the plane is kept in the green area, the pilot's only worry is to keep the ship properly levelled off for landing.

The colored pathways of light are seen only by incoming pilots as they drop toward the runways and a pilot looking down the runway can see but one color at a time. In daytime the pilot can see the colors just as unmistakably.

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THROUGH  
THE YEARS



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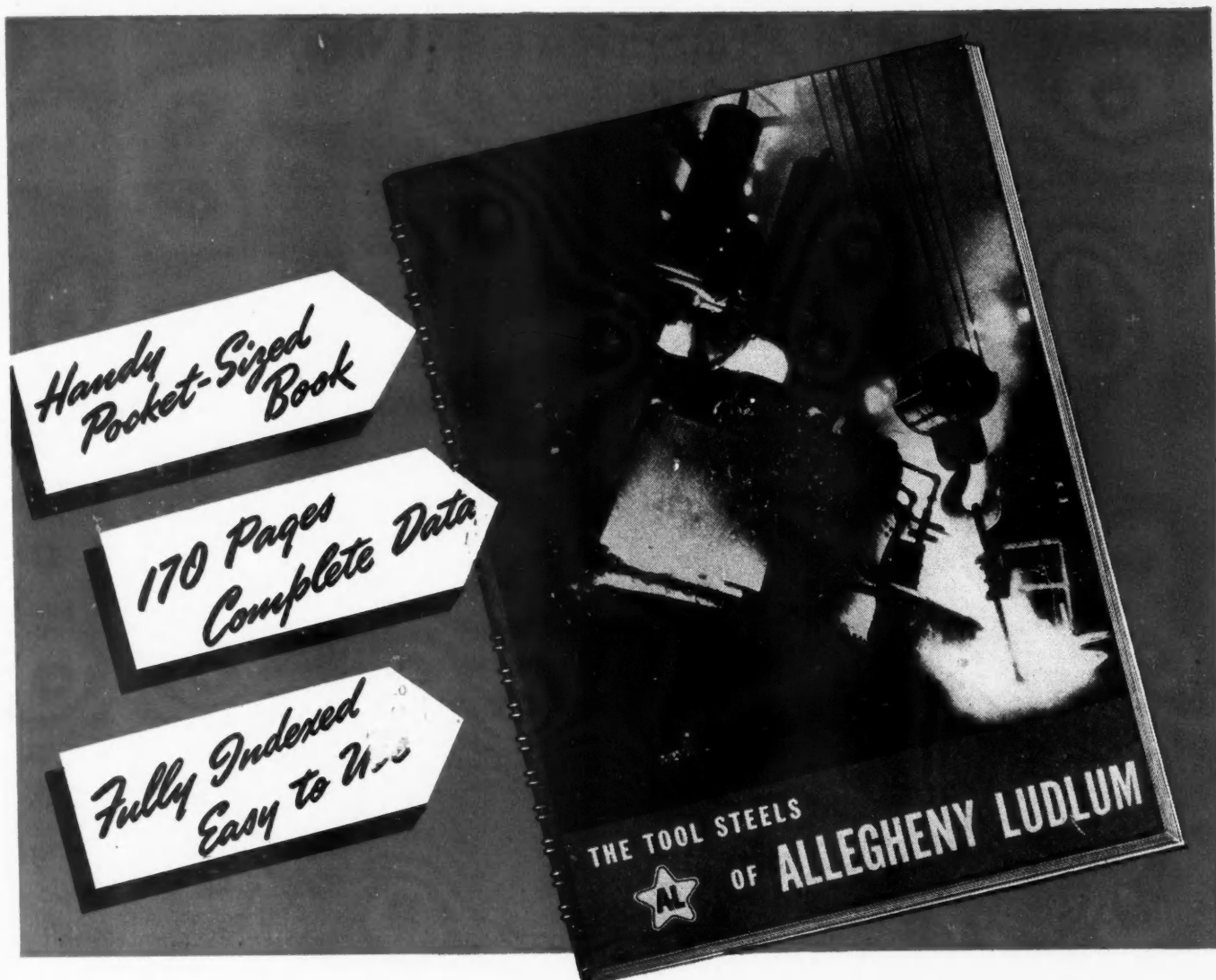
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# ALLEGHENY LUDLUM

STEEL CORPORATION • General Offices, Brackenridge, Pa.

*Pioneer in Specialloy Steels*

# I-40 Jet Propulsion Gas Turbine

(Continued from page 38)

tal trunnions come out between air adapters at the rear air inlet very near to the center of gravity of the gas turbine. The front support can be mounted on either the top or the bottom of the gear set depending upon the application.

The accessory drive consists of an outer casing which carries the various accessories, and a rotor cage which fits inside of the casing and carries all of the gears and most of the bearings.

The outer casing also acts as the oil reservoir for the gas turbine.

The compressor rotor consists of an impeller with stub shafts bolted on each side. The front shaft is carried by a ball bearing and the rear shaft is carried by a roller bearing. Axial clearance is adjusted by a sliding ring which carries the outer race of the ball bearing. These bearings are carried in bearing support casings which bolt to the flanges of the accessory drive on one

end and the turbine and combustion assembly on the other end. Truss rings are fastened to these same flanges and span the front and rear air inlets supporting the compressor casings and the diffuser. The diffuser is a box-type single casting with the elbows and turning vanes cast integrally. The compressor casings form the side walls of the impeller and support part of the inlet guide vanes.

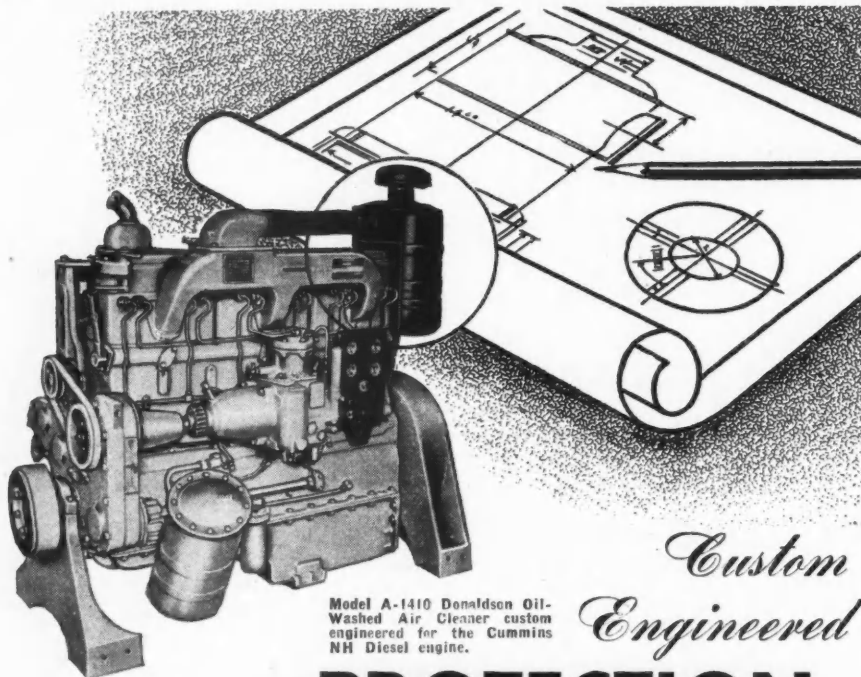
The turbine and combustion assembly consists of a turbine bearing support, a turbine rotor, and a set of combustion chambers. The turbine rotor has a shaft flash-welded to the wheel and has buckets dovetailed to the rim of the wheel. The rotor is carried by a roller bearing at the rear end and a ball bearing at the front end. The axial clearance is adjusted in the same manner as it is for the compressor rotor by means of a sliding ring which carries the outer race of the ball bearing. The bearing support is covered with a shroud so that the cooling air can be brought along the inner wall. It then passes out through the cooling fan on the front side of the turbine wheel, cooling the turbine wheel, and finally emerges through the spaces of the combustion chambers. The 14 combustion chambers are arranged around the turbine with their axis conical, joining together at the turbine inlet to provide an annular flow of hot gas. The turbine nozzles are mounted between the two rings around the discharge of the combustion chambers. At the entrance end of each combustion chamber, a piston ring joint is used in order to allow for expansion due to heating. The flange of the turbine bearing support which joins to the compressor assembly and the flange around the turbine nozzle ring which joins to the exhaust cone are connected by tie straps made of Invar so that there will be no relaxation when heated.

The exhaust cone consists of an outer cone and an inner cone which is supported by four struts from the outer cone. The outer cone is insulated on the outside by an aluminum foil and wire mesh blanket. The large front flange of the outer cone acts as a shroud for the turbine buckets. The small rear flange of the outer cone connects to the exhaust pipe.

The air adapters are aluminum castings and carry the fuel nozzles, domes of the combustion chambers, and spark plugs. These are so designed that they can be removed from the gas turbine for inspection of the fuel nozzles, domes and liners. The fuel nozzles, domes and liners can be replaced, if necessary, by removing the air adapters.

Fig. 2 shows the lubrication system of the I-40. The oil pump has two elements, a lubrication element and a

(Turn to page 96, please)



## air cleaner PROTECTION

The Donaldson trademark on an air cleaner installation is assurance that it is "custom engineered". In our position as the first and now the world's largest manufacturer of heavy duty air cleaners, we know that too much is at stake in the way of power unit operating costs and dependability, to gamble with an air cleaner installation that is not properly fitted to the power unit.

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DIVISION SIMONDS TACONY AND STEEL CO.

Time-honored  
abrasive products  
are now further  
distinguished by  
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For more than half a century the name Abrasive Company has been synonymous with high quality grinding wheels and abrasive products. With the years has come a tremendous increase in the use of such products and the unqualified trademark designation "Abrasive" is now inadequate as a general term to distinguish this old company. Therefore, in order to establish a more distinctive identity for the organization, a more individual crest for its quality and service, the name Simonds, renowned for over a century for excellence in cutting tools, will designate product and company.

Operating under the same management and policies, SIMONDS ABRASIVE COMPANY will continue to turn out the same products of top performance which so distinguished the Abrasive Company during the past half century. SIMONDS ABRASIVE COMPANY goes forward, pledged to continue to justify the confidence of its old customers and to merit and inspire the patronage and good will of new ones.

SIMONDS ABRASIVE CO., TACONY AND FRALEY STS., PHILADELPHIA 37, PA.

scavenging element. The lubrication element draws oil from the reservoir which is in the bottom of the accessory drive casing. The oil passes through a filter and is delivered to the four main bearings, to the coupling sleeve between the turbine and compressor rotor, and to the quill shaft splines which drive the accessory drive. Oil from the front compressor bearing and from the accessory drive quill shaft drains directly into the oil reservoir. Oil from the other three main bearings and from the coupling sleeve drains into a sump from which it is drawn by the scavenger pump and then delivered back into the oil reservoir. At a gas turbine speed

of 11,500 rpm, the oil pump has a displacement of about 3 gpm and the scavenging pump of about 10 gpm. Last chance screens are provided immediately ahead of all oil jets to prevent their plugging.

The gears and bearings in the accessory drive are lubricated by splash from the gear which drives the oil pump. This gear is under the oil level and is protected by a shroud. A small amount of oil is admitted to the inside of the shroud through an orifice in the bottom. Thus, the quantity of oil for lubricating the gears and bearings is metered and the oil in the reservoir is not churned into foam by the gears.

The gear casing is vented by a pipe to a point aft of the baffle on the rear side of the rear compressor inlet. This vent opens into the accessory drive casing near the center of the front side, thus, oil will not run out of the vent at any attitude of the gas turbine.

Take-off and Military Rating of the I-40 is for 15 minutes at 11,500 rpm. Normal rating is for continuous operation at 11,000 rpm. Idling speed, the minimum continuous operating speed, is 3500 rpm.

Fig. 3 shows the thrust of 21 I-40 gas turbines built at Lynn. The actual test points are shown, corrected to standard conditions. The single line gives the average of the data. It passes through 4000 lb at 11,500 rpm.

Fig. 4 shows the fuel consumption of the I-40, on the same basis as the previous curve. Average fuel consumption at 11,500 rpm is 4740 lb per hr.

Fig. 5 shows the specific fuel consumption of the I-40 on the same basis as the previous curves. At 11,500 rpm it is 1.185 lb per hr per lb thrust.

Fig. 6 shows the exhaust temperature of the I-40 on the same basis as the previous curves. At 11,500 rpm it is 1170 F.

Table II gives the average performance of the I-40 on the same basis as the previous curves. The data for Thrust, Fuel Flow, Specific Fuel Consumption, and Exhaust Temperature are from the curves.


## Let's Have Responsibility On the Union's Side

(Continued from page 17)

to manage production without interference. This cannot be done if all efforts in that direction are resisted by unauthorized stoppages and slowdowns.

Another factor is that management is determined to obtain something in exchange for the many expensive functions it performs for the union. These include the dues checkoff, maintenance of membership, payment of wages to union members while on union business, and many others. Ford reports that it cost the company more than \$2.8 million for these services last year in the Dearborn area alone. Since the union contract was signed in 1941 there have been 773 unauthorized work stoppages. That is why Ford and all other companies must have from the union the same measure of security that management extends to unions.

*A front row seat for the parade of developments if you continue to read AUTOMOTIVE and AVIATION INDUSTRY.*



**In the realm of forging design and the development of proper grain flow Wyman-Gordon has long pioneered and has originated many forging designs which, at the time of their development, were considered impossible to produce by forging. Whatever your production problem, Wyman-Gordon engineers will be found ready to study it and report to you how modern forging can give you the most satisfactory results.**

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Steels. Nitralloy Steels. Triple Alloy and Special Analysis Steels, as well as other AISI Steels. In all grades, in all finishes and treatments, and in the widest range of forms and sizes available anywhere. They are produced either by Electric Furnace or Open Hearth process.

Literally millions of tons of these special purpose steels have been successfully used in critical wartime applications. Here, in the severest test that steel has ever had to face, U·S·S Carilloy Steels have done an outstanding job that has earned

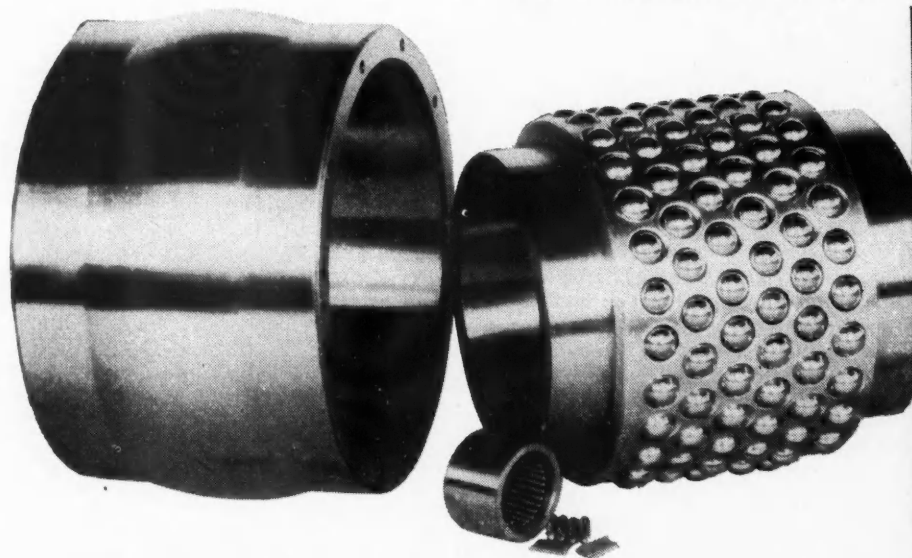
them a place right at the top of your list when tough postwar assignments are under consideration.

Produced both in our Chicago and Pittsburgh plants, these superior alloy steels — and the specialized metallurgical and engineering knowledge accumulated in their application—are available to give your products those qualities of greater efficiency, greater permanence and greater sales appeal, that will help to place it not merely abreast, but ahead of competition. We welcome the opportunity to work with you.

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*Pittsburgh and Chicago*

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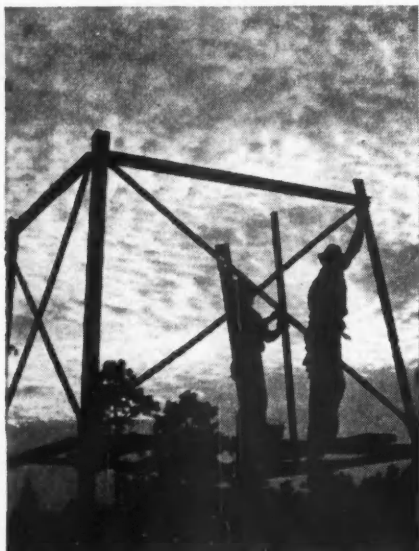
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# UNITED STATES STEEL





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**WELL WATER SYSTEMS  
VERTICAL TURBINE PUMPS**

## Motor Car Prospects in Britain

(Continued from page 25)

of factory space required to build plastic bodies would be far greater than where normal steel construction is concerned. This is because the number of molds required would be very much more, and, moreover, the heating and drying times for plastic is much greater than that demanded for the pressing out of a sheet of steel to the desired contours. The problem of repairing plastics, too, has to be commercialized. Whereas the conventional steel panel body can be repaired at the local garage, quite minor damage to a plastic panel might involve access to complicated equipment, which would not be readily available except in established manufacturing centers.

Steel production, of course, has undergone something of a revolution during this war, and thanks to improvements in electrical smelting processes, metallurgical research, and a better understanding of molecular structures—all developments accelerated by the needs of battle—steels can now be made which are stronger, tougher, and more readily machineable than their predecessors.

In the matter of body finishes I think it is highly probable that we shall see very much brighter colors in use than was formerly the case, and this may largely be the result of the lessons learned in the Western Desert, where we were forced to discover a fadeless camouflage to combat the fierce sunlight. It was not possible in the past to make extensive use of delicate colors for motor car bodies because of their tendency to fade under exposure to severe weather conditions. And once a car had been in use for months, it was almost impossible to match up the paint work when part-repainting after local damage became necessary. There is, too, a new double-flow solvent which in the case, say, of a repainted patch on a beaten-out wing, will dissolve the edge of the old paint and allow it to merge into the newly-painted surface, thus providing invisible touch-up.

The postwar car, also, may well have automatically adjusting brakes, accomplished by a small hydraulic ratchet that will take up the slack as the lining wears and guarantees that the driver always has "plenty under the brake pedal."

The British automobile trade is trying to make ready for normalcy, but all problems I have hastily touched on need to be worked out in detail.

### Advertising Note

The Charles Blum Advertising Corp., Philadelphia, Pa., has appointed Harry M. Ellsworth as manager of the Industrial and Technical Advertising Department. Mr. Ellsworth was formerly general advertising manager of the Pennsylvania Salt Manufacturing Co.

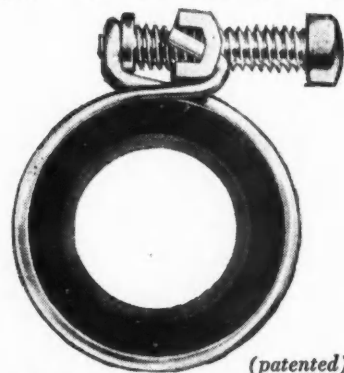
## Ripley take note...



... believe it or not ... here's a wire hose clamp that tells Mr. Hose ... "You can't leak any more, any more." It encircles the hose with a steel-vise grip at every point of its 360° circumference, and NEVER lets go!

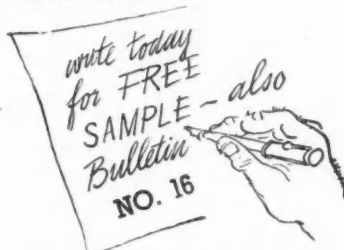


Manufacturers, Mechanics, Owners ... take notice. The Central "360" Wire Hose Clamp is sold with an unconditional guarantee that it will do its job—no "clinches" barred!



(patented)

P.S. No shock, jolt or vibration can lessen or loosen the powerful grip of the "360" clamp. Costs no more ... but worth much more.



**CENTRAL "360"  
WIRE HOSE CLAMP  
CENTRAL EQUIPMENT CO.  
900 S. WABASH AVENUE, CHICAGO 6, ILL.**

## Cost Consciousness

(Continued from page 31)

are adjusted upon the basis of 24 hours per day, second column Table I, the figures are considerably more alarm-

Table I

	8-hr day (per cent)	24-hr day (per cent)
Productive machine time	38	12.6
Set-up time	40	13.3
Idle time	18	72.8
Maintenance	4	1.3

ing. The idea that equipment is idle 72.8 per cent of the time and productive only 12.6 per cent would be disturbing to any production man. But let us consider what caused such a condition.

What is the productive machine time of a lathe that normally operates eight hours per day? Even if weekends and holidays are neglected, the best possible productive machine time is 33 per cent. If due to poor, or no scheduling, there is no work assigned to the lathe one-fifth of the working day, the productive machine time is reduced to 26.4 per cent. Then, if due to poor tooling or poor design of the lathe, one-third of the remaining time is consumed in setting up the work, changing tools, speeds and feeds, the over-all productive machine time will be reduced to 17.6 per cent.

Before one concludes that such a situation as has been described is unrealistic, he should remember that a machine is productive only when it is actually operating and that peacetime conditions are assumed. It might also be a good idea to time some machines in one's own plant to determine exactly what portion of the total time they are operating.

In the example just given, notice that the greatest decrease in productive machine time, from 100 per cent to 33 per cent, was due to poor or no planning. If a piece of equipment, or a plant, is operated only one shift per day, it is probable that the available capacity is about three times as great as is necessary. In the prewar years there was entirely too little thought given to the possibility of multi-shift operation. Planning in the postwar period must consider this possible method for increasing productive machine time and reducing overhead costs.

Before new or additional equipment is purchased one should be certain that existing equipment has the highest possible productive machine time and that the new equipment is of the proper size to allow it to be operated at a high rate of productivity. This should certainly be considered by those companies which are considering buying Government-owned plants or equipment. It is to be questioned whether a property is a bargain, no matter how cheaply it can be purchased, if it cannot be utilized effectively.

The loss in productive machine time  
(Turn to page 104, please)

January 1, 1946

# Engineered Fastenings

## for MORE PRODUCTION at LESS COST

### HOLTITE

For over 42 years this name has guided American industry in its selection of dependable screws, bolts and allied fastenings. Alert to all technical and mechanical advances, we are equipped with every modern engineering, laboratory, and production facility. But most important, is the technical talent, combined scientific knowledge and special experience of our Engineering and Research Staffs.

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# CONTINENTAL

## SCREW CO.

New Bedford, Mass., U.S.A.



due to no work being scheduled for a machine should of course be considered. Many plants had their first extensive experience with scheduling during the war. Many adopted scheduling as a means of enabling them to meet scheduled delivery dates. They have been interested, primarily, in being certain that all necessary parts and materials were available at the right time at the right place. Unfortunately, many companies used their scheduling system only as a method of determining where to send their expeditors.

Scheduling should, of course, assure that the correct material is at the correct place at the correct time. But

scheduling can do more than this. It should be applied to machines as well as materials and thus control machine loading and thereby help to increase productive machine time. Machine loading charts will be of great value in postwar years. A daily report of idle machine time will be just as valuable as a daily report on overtime or failure to meet scheduled output.

Though planning and scheduling are very important, as indicated above, even more attention should be given to non-productive machine time due to set-up requirements and the necessity for putting work into, and taking it out of machines. This is represented by

the 40 per cent shown in Table I. Those operations which require machines to be stopped and remain inoperative should be reduced to a minimum, both in number and duration. It is here that motion study and good tooling can be of great help. One of the prime requisites of good tooling is that it shall be in accord with the principles of motion economy.

Although a machine may operate at a high speed when it is running, if it is standing still for a considerable portion of the time in order for the operator to get work set up or removed, its over-all productive time is low. Time required to service a machine—that is to set up and remove work, is not productive. This means that careful attention should be given to the possible use of multiple station fixtures, quick acting clamps, proper loading and unloading heights, centralized controls, mechanical aids, use of the proper sub-assembly sizes, duplication of essential aids so that one set-up can be prepared while another is being machined or produced. In other words, ample attention should be given to all subsidiary operations which must be done in order for a machine to operate.

During the war many plants learned of the great increases in production that can be obtained through proper tooling. Unfortunately there has not been much emphasis upon the economics of tooling. Production men should start now to learn how to determine what type and amount of tooling is justified. Tool designers should remember that in peacetime tooling is used for just one purpose—to lower costs. There will be no bonus for increased output if it is not obtained at lower cost.


The points which have been presented here are not all that must be considered by production men in reconverting their thinking for the postwar years. But they should be sufficient to bring home the fact that some reconverting will have to be done. While we are reconverting our plants, we should also reconvert our thinking about production costs.

#### Detrex Moves Los Angeles Branch to Larger Quarters

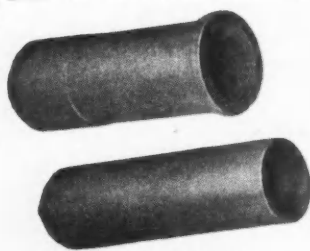
New and larger Pacific Coast Region offices of Detrex Corp., Detroit, Mich., have been established at 112 West Ninth Street, Los Angeles, Cal.

This office, which is under the supervision of Mr. S. B. Crooks, Pacific Region manager, functions as sales and service headquarters for the Pacific Coast and Rocky Mountain states. In addition to controlling division offices in the territory, the Los Angeles branch supervises all local stocks of alkali- and emulsion-compounds, vapor-degreasing solvents and standard metal cleaning machines. Direct customer service for Southern California is also handled from this office.

# G U N I T E



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